ACADEMIC CURRICULUM

(REGULATIONS 2019)

FOR

UNDER GRADUATE PROGRAMMES

CHOICE BASED CREDIT SYSTEM

(Applicable to the students admitted from the Academic Year 2019- 20 onwards)

B.E. – BIOMEDICAL ENGINEERING

EASWARI ENGINEERING COLLEGE

(AN AUTONOMOUS INSTITUTION)

BharathiSalai, Ramapuram, Chennai – 600 089

CONTENTS

SEMESTER I								
S.No	Course Code	Course Title	Category	Hours/Week				Credits
				L	T	P	R	
THEORY								
1.	191LEH101T	Technical English	HS	3	-	-	-	3
2.	191MAB101T	Engineering Mathematics - I	BS	3	2	-	-	4
3.	191PYB101T	Engineering Physics	BS	3	-	-	-	3
4.	191CYB101T	Engineering Chemistry	BS	3	-	-	-	3
5.	191GES101T	Engineering Graphics	ES	2	-	4	-	4
6.	191GES102T	Problem Solving through Python Programming	ES	3	-	-	-	3
LABORATORY								
7.	191GEB111L	Physics and Chemistry Laboratory	BS	-	-	4	-	2
8.	191GES111L	Python Programming Laboratory	ES	-	-	3	1	2
TOTAL CREDITS								**24**
MANDATORY COURSE								
9.	191GEM101L	Induction Training[&]	MC	-	-	2	-	1[&]

[&] Mandatory to attend Induction training programme and earn one credit.

SEMESTER II								
S.No	Course Code	Course Title	Category	Hours/Week				Credits
				L	T	P	R	
THEORY								
1.	191LEH201T	Professional Communication/ BEC Certification	HS	3	-	-	-	3
2.	191MAB201T	Engineering Mathematics - II	BS	3	2	-	-	4
3.	191GES201T	Basic Electrical and Electronics Engineering	ES	3	0	-	-	3
4.	191GES202T	Engineering Mechanics	ES	3	2	-	-	4
5.	191EIC201T	Electric Circuit Analysis	PC	3	2	-	-	4
LABORATORY								
6.	191GES211L	Engineering Practices Laboratory	ES	-	-	4	0	2
7.	191GES212L	Basic Electrical and Electronics Engineering Laboratory	ES	-	-	3	1	2
TOTAL CREDITS								**22**
MANDATORY COURSE								
8.	191CYM201T	Environmental Science&&	MC	3	-	-	-	3&&
9.	191GEM211L	NSS / NCC / YRC – Phase - I*	MC	-	-	2	-	1*

* The student may opt for any one. They have to complete the respective Phase II and Phase III. Those who are not opting NSS/NCC/YRC have to opt for Foreign language / Indian constitution in the sixth semester.

&& Mandatory to register for the course and earn three credits

SEMESTER III								
S.No	Course Code	Course Title	Category	Hours/Week				Credits
				L	T	P	R	
THEORY								
1.	191MAB301T	Transforms and Partial Differential Equations	BS	3	2	-	-	4
2.	191EIS301T	Electronic Devices and Circuits	ES	3	-	-	-	3
3.	191BMC301T	Sensors and Measurements	PC	3	-	-	-	3
4.	191BMH301T	Hospital Management	HS	3	-	-	-	3
5.	191BMB301T	Anatomy and Physiology	BS	3	-	-	-	3
LABORATORY								
6.	191BMS311L	Devices and Circuits Laboratory	PC	-	-	3	1	2
7.	191BMC312L	Sensors and Measurements Laboratory	PC	-	-	3	1	2
HUMAN EXCELLENCE COURSE								
8.	191GEH311L	Yoga / Social Service – Phase - I**	HS	-	-	2	-	1
TOTAL CREDITS								**21**
EMPLOYABILITY ENHANCEMENT COURSE								
9.	191BMA311I	Inplant Training / Internship[#]	EEC	-	-	-	-	1[#]
10.	191BMA301I	Industry Supported Course (Optional)[##]	EEC	1	-	-	-	1[##]
ONLINE COURSE								
11.		Online Course (Optional)[$]	PE	-	-	-	-	3[$]

** Student may opt for any one. They have to complete the respective Phase II in semester V.

[#] Mandatory to do Internship and earn minimum one credit between 3rd and 6th semester.

[##] Students may earn credits in lieu of Professional elective -V in 8th semester. Please refer Clause 26.1.1 of B.E. Regulations 2019.

[$] Online courses of three credits each can be considered in lieu of Professional Elective –IV and Professional Elective –VI. A student earned only three credits can drop only Professional Elective –VI. Please refer Clause 14.9 of B.E. Regulations 2019.

SEMESTER IV								
S.No	Course Code	Course Title	Category	Hours/Week				Credits
				L	T	P	R	
THEORY								
1.	191BMC401T	Fundamentals of Biochemistry	PC	3	-	-	-	3
2.	191BMC402T	Analog and Digital Integrated Circuits	PC	3	-	-	-	3
3.	191BMC403T	Physiological Control Systems	PC	3	-	-	-	3
4.	191BMC404T	Biomechanics	PC	3	-	-	-	3
5.	191CSS422T	Object Oriented Programming using C++	ES	3	-	-	-	3
LABORATORY								
6.	191BMC411L	Biochemistry Laboratory	PC	-	-	1	1	1
7.	191BMC412L	Human Physiology laboratory	PC	-	-	1	1	1
8.	19IBMC413L	Analog and Digital Integrated Circuits Laboratory	PC	-	-	3	1	2
TOTAL CREDITS								**19**
MANDATORY COURSE								
9.	191GEM411L	NSS / NCC / YRC - Phase - II*	MC	-	-	2	-	1*
EMPLOYABILITY ENHANCEMENT COURSE								
10.	191BMA411I	Inplant Training / Internship#	EEC	-	-	-	-	1#
11.	191BMA401I	Industry Supported Course (Optional) ##	EEC	1	-	-	-	1##
ONLINE COURSE								
12.		Online Course (Optional) $	PE	-	-	-	-	3$

* Students have to complete the respective phase II.

\# Mandatory to do Internship and earn minimum one credit between 3rd and 6th semester.

\## Students may earn credits in lieu of Professional elective –V in 8th semester. Please refer Clause 26.1.1 of B.E. Regulations 2019.

$ Online courses of three credits each can be considered in lieu of Professional Elective –IV and Professional Elective –VI. A student earned only three credits can drop only Professional Elective –VI. Please refer Clause 14.9 of B.E. Regulations 2019.

SEMESTER V								
S.No	Course Code	Course Title	Category	Hours/Week				Credits
				L	T	P	R	
THEORY								
1.	191BMC501T	Microcontroller and Embedded C	PC	3	-	-	-	3
2.	191BMC502T	Bio-MEMS and Bio-NEMS	PC	3	-	-	-	3
3.	191BMC503T	Biomedical Instrumentation	PC	3	-	-	-	3
4.		Professional Elective – I	PE	3	-	-	-	3
5.		Open Elective – I	OE	3	-	-	-	3
LABORATORY								
6.	191BMC511L	Microcontroller & Embedded C Laboratory	PC	-	-	3	1	2
7.	191BMC512L	Biomedical Instrumentation Laboratory	PC	-	-	4	-	2
8.	191BMA511I	Summer Internship / Summer Project (minimum 4 weeks)	EEC	-	-	-	-	2
HUMAN EXCELLENCE COURSE								
9.	191GEH511L	Yoga / Social Service – Phase - II**	HS	-	-	2	-	1
TOTAL CREDITS								**22**
EMPLOYABILITY ENHANCEMENT COURSE								
10.	191BMA511I	In plant Training / Internship#	EEC	-	-	-	-	1#
11.	191BMA501I	Industry Supported Course (Optional) ##	EEC	1	-	-	-	1##
ONLINE COURSE								
12.		Online Course (Optional) $	PE	-	-	-	-	3$

** Students have to complete the respective phase II.

Mandatory to do Internship and earn minimum one credit between 3rd and 6th semester.

Students may earn credits in lieu of Professional Elective -V in 8th semester. Please refer Clause 26.1.1 of B.E. Regulations 2019.

$ Online courses of three credits each can be considered in lieu of Professional Elective –IV and Professional Elective –VI. A student earned only three credits can drop only Professional Elective –VI. Please refer Clause 14.9 of B.E. Regulations 2019.

SEMESTER VI								
S.No	Course Code	Course Title	Category	Hours/Week				Credits
				L	T	P	R	
THEORY								
1.	191BMC601T	Diagnostic and Therapeutic Equipment	PC	3	-	-	-	3
2.	191BMC602T	Biosignal Processing	PC	3	-	-	-	3
3.	191BMH601T	Psychological Process	HS	3	-	-	-	3
4.		Professional Elective – II	PE	3	-	-	-	3
5.		Open Elective – II	OE	3	-	-	-	3
LABORATORY								
6.	191BMC611L	Diagnostic and Therapeutic Equipment Laboratory	PC	-	-	3	1	2
7.	191BMC612L	Biosignal Processing Laboratory	PC	-	-	3	1	2
TOTAL CREDITS								**19**
MANDATORY COURSE								
8.	191GEM611L	NSS / NCC / YRC - Phase - III*	MC	-	-	2	0	1*
9.	191GEM601T	Foreign Language / Indian Constitution&	MC	3	-	-	-	3&
EMPLOYABILITY ENHANCEMENT COURSE								
10.	191BMA611I	Inplant Training / Internship#	EEC	-	-	-	-	1#
11.	191BMA601I	Industry Supported Course (Optional) ##	EEC	1	-	-	-	1##
ONLINE COURSE#								
12.		Online Course (Optional) $	PE	-	-	-	-	3$

* Students have to complete the respective phase III.

& Students those who have not earned 3 credits through NSS / NCC / YRC must register for this course and earn 3 credits.

Mandatory to do Internship and earn minimum one credit between 3rd and 6th semester.

Students may earn credits in lieu of Professional Elective -V in 8th semester. Please refer Clause 26.1.1 of B.E. Regulations 2019.

$ Online courses of three credits each can be considered in lieu of Professional Elective –IV and Professional Elective –VI. A student earned only three credits can drop only Professional Elective –VI. Please refer Clause 14.9 of B.E. Regulations 2019.

SEMESTER VII								
S.No	Course Code	Course Title	Category	Hours/Week				Credits
				L	T	P	R	
THEORY								
1.	191BMC701T	Medical Image Processing	PC	3	-	-	-	3
2.	191BMC702T	Radiological Equipment	PC	3	-	-	-	3
3.		Professional Elective – III	PE	3	-	-	-	3
4.		Professional Elective – IV	PE	3	-	-	-	3
5.		Open Elective – III	OE	3	-	-	-	3
6.	191BMA701T	Comprehension[@]	PE	-	-	-	-	3[@]
LABORATORY								
7.	191BMC701L	Hospital Training	PC	-	-	4	-	2
8.	191BMC702L	Medical Image Processing Laboratory	PC	-	-	3	1	2
EMPLOYABILITY ENHANCEMENT COURSE								
9.	191BMP711J	Project Work / Start up – Phase - I	EEC	-	-	-	4	2
10.	191BMA711I	Inplant Training / Internship[#]	EEC	-	-	-	-	1
TOTAL CREDITS								**22**
11.	191BMA701	Industry Supported Course (optional)[##]	EEC	1	-	-	-	1[##]
ONLINE COURSE[#]								
12.		Online Course (optional) [$]	PE	-	-	-	-	3[$]

[@] Students may earn credits in lieu of Professional elective – III in 7th semester. Please refer clause 26.2 of B.E. Regulations 2019

[#] Mandatory to earn at least one credit by doing internship between 3rd and 6th semester with one credit reflecting in this semester for CGPA calculation.

[##] Students may earn credits in lieu of Professional Elective -V in 8th semester. Please refer Clause 26.1.1 of B.E. Regulations 2019.

[$] Online courses of three credits each can be considered in lieu of Professional Elective –IV and Professional Elective –VI. A student earned only three credits can drop only Professional Elective –VI. Please refer Clause 14.9 of B.E. Regulations 2019.

SEMESTER VIII								
S.No	Course Code	Course Title	Category	Hours/Week				Credits
				L	T	P	R	
THEORY								
1.		Professional Elective -V	PE	3	-	-	-	3
2.		Professional Elective -VI	PE	3	-	-	-	3
EMPLOYABILITY ENHANCEMENT COURSE								
3.	191BMP811J	Project Work / Start up – Phase - II	EEC	-	-	-	20	10
TOTAL CREDITS								16

.

PROGRAMME TOTAL CREDITS = 165

HUMANITIES & SOCIAL SCIENCE COURSES (HS)

Sl. No.	Subject Code	Subject	Semester	Credits
1.	191LEH101T	Technical English	I	3
2.	191LEH201T	Professional Communication/ BEC Certification	II	3
3.	191GEH311L	Yoga / Social Service (Phase I)	III	1
4.	191BMH301T	Hospital Management	III	3
5.	191GEH511L	Yoga / Social Service – Phase - II**	V	1
6.	191BMH601T	Psychological Process	VI	3
TOTAL CREDITS				**14**

BASIC SCIENCE COURSES (BS)

Sl. No.	Subject Code	Subject	Semester	Credits
1.	191MAB101T	Engineering Mathematics - I	I	4
2.	191PYB101T	Engineering Physics	I	3
3.	191CYB101T	Engineering Chemistry	I	3
4.	191GEB111L	Physics and Chemistry Laboratory	I	2
5.	191MAB201T	Engineering Mathematics - II	II	4
6.	191MAB301T	Transforms and Partial Differential Equations	III	4
7.	19IBMB301T	Anatomy and Physiology	III	3
TOTAL CREDITS				**23**

ENGINEERING SCIENCE COURSES (ES)

Sl. No.	Subject Code	Subject	Semester	Credits
1.	191GES101T	Engineering Graphics	I	4
2.	191GES102T	Problem Solving through Python Programming	I	3
3.	191GES111L	Python Programming Laboratory	I	2
4.	191GES201T	Basic Electrical and Electronics Engineering	II	3

5.	191GES202T	Engineering Mechanics	II	4
6.	191GES211L	Engineering Practices Laboratory	II	2
7.	191GES212L	Basic Electrical and Electronics Engineering Laboratory	II	2
8.	191EIS301T	Electronic Devices and Circuits	III	3
9.	191BMS311L	Devices and Circuits Laboratory	III	2
10.	191CSS422T	Object Oriented Programming using C++	IV	3
TOTAL CREDITS				**28**

PROFESSIONAL CORE COURSES (PC)

Sl. No.	Subject Code	Subject	Semester	Credits
1.	191EIC201T	Electric Circuit Analysis	II	4
2.	191BMC301T	Sensors and Measurements	III	3
3.	191BMC311L	Sensors and Measurements Laboratory	III	2
4.	191BMC401T	Fundamentals of Biochemistry	IV	3
5.	191BMC402T	Analog and Digital Integrated Circuits	IV	3
6.	191BMC403T	Physiological Control Systems	IV	3
7.	191BMC404T	Biomechanics	IV	3
8.	191BMC411L	Biochemistry Laboratory	IV	1
9.	191BMC412L	Human Physiology laboratory	IV	1
10.	19IBMC413L	Analog and Digital Integrated Circuits Laboratory	IV	2
11.	191BMC501T	Microcontroller and Embedded C	V	3
12.	191BMC502T	Bio-MEMS and Bio-NEMS	V	3
13.	191BMC503T	Biomedical Instrumentation	V	3
14.	191BMC511L	Microcontroller & Embedded C Laboratory	V	2
15.	191BMC512L	Biomedical Instrumentation Laboratory	V	2
16.	191BMC601T	Diagnostic and Therapeutic Equipment	VI	3
17.	191BMC602T	Biosignal Processing	VI	3
18.	191BMC611L	Diagnostic and Therapeutic Equipment Laboratory	VI	2
19.	191BMC612L	Biosignal Processing Laboratory	VI	2
20.	191BMC701T	Medical Image Processing	VII	3

21.	191BMC702T	Radiological Equipment	VII	3
22.	191BMC701L	Hospital Training	VII	2
23.	191BMC702L	Medical Image Processing Laboratory	VII	2
TOTAL CREDITS				**58**

PROFESSIONAL ELECTIVE COURSES (PE)

Sl. No.	Subject Code	Subject	Semester	Credits
1.	191BMA701T	Comprehension[@]	VII	3[@]
Professional Elective - I				
1.	191BME501T	Medical Ethics and Standards	V	3
2.	191BME502T	Biomaterials and Artificial Organs	V	3
3.	191BME503T	Medical Optics	V	3
4.	191BME504T	Medical Physics	V	3
5.	191BME505T	Rehabilitation Engineering	V	3
6.	191BME506T	Principles of Tissue Engineering	V	3
Professional Elective –II				
7.	191BME601T	Communication Engineering	VI	3
8.	191BME602T	Advanced Microcontrollers	VI	3
9.	191BME603T	Real Time Embedded Systems	VI	3
10.	191BME604T	Computer Architecture and Organization	VI	3
11.	191BME605T	Virtual Instrumentation	VI	3
12.	191BME606T	Biostatistics	VI	3
Professional Elective –III				
13.	191BME701T	Pattern Recognition and Neural Networks	VII	3
14.	191BME702T	Wavelet Transforms and its Applications	VII	3
15.	191BME703T	Ultrasound Principles and Applications in Medicine	VII	3
16.	191BME704T	Neural Engineering	VII	3

1.	191BME705T	Foundations for Nano Electronics	VII	3
2.	191BME706T	Speech Processing	VII	3
Professional Elective - IV				
3.	191BME711T	Medical Informatics	VII	3
4.	191BME712T	Body Area Networks	VII	3
5.	191BME713T	Wearable Systems	VII	3
6.	191BME714T	Computer Hardware and Interfacing	VII	3
7.	191BME715T	Multimedia Compression and Networks	VII	3
8.	191BME716T	Internet of Things in Medicine	VII	3
Professional Elective -V				
9.	191BME801T	Biometric Systems	VIII	3
10.	191BME802T	Biomaterials and Characterisation	VIII	3
11.	191BME803T	Physiological Modelling	VIII	3
12.	191BME804T	Virtual Reality in Medicine	VIII	3
13.	191BME805T	Advanced Bioanalytical and Therapeutic Techniques	VIII	3
14.	191BME806T	Electro Magnetic Interference and Compatibility	VIII	3
Professional Elective -VI				
15.	191BME811T	Brain Computer Interface and Applications	VIII	3
16.	191BME812T	Cryptography and Network Security	VIII	3
17.	191BME813T	Robotics	VIII	3
18.	191BME814T	Soft Computing and Applications	VIII	3
19.	191BME815T	VLSI Design	VIII	3
20.	191BME816T	Foundation Skills in Integrated Product Development	VIII	3
TOTAL CREDITS				**18**

EMPLOYABILITY ENHANCEMENT COURSES (EEC)

Sl. No.	Subject Code	Subject	Semester	Credits
1.		Inplant Training / Internship	III to VII	3
2.		Industry Supported Course	IV to VII	3
3.	191BMP711J	Project Work / Start up – Phase - I	VII	2
4.	191BMP811J	Project Work / Start up – Phase - II	VIII	10

MANDATORY COURSES (M)

Sl. No.	Subject Code	Subject	Semester	Credits
1.	191GEM101L	Induction Training	I	1
2.	191CYM201T	Environmental Science	II	3
3.	191GEM211L	NSS / NCC / YRC (Phase I)	II	1
4.	191GEM411L	NSS / NCC / YRC (Phase II)	IV	1
5.	191GEM611L	NSS / NCC / YRC (Phase III)	VI	1
6.	191GEM601T	Foreign Language / Indian Constitution	VI	3

CREDIT DISTRIBUTION

SEMESTER →	I	II	III	IV	V	VI	VII	VIII	CREDIT
Humanities and Social Sciences (HS)	3	3	4	-	1	3	-	-	**14**
Basic Sciences (BS)	12	4	7	-	-	-	-	-	**23**
Engineering Sciences (ES)	9	11	5	3	-	-	-	-	**28**
Professional Core (PC)	-	4	5	16	13	10	10	-	**58**
Professional Electives (PE)	-	-	-	-	3	3	6	6	**18**
Open Electives (OE)	-	-	-	-	3	3	3	-	**9**
Employability Enhancement Courses (EEC)	-	-	-	-	2	-	3	10	**15**
Total Credit	**24**	**22**	**24**	**16**	**22**	**19**	**22**	**16**	**165**

NON CGPA COURSES DETAILS

	I	II	III	IV	V	VI	VII	VIII	Minimum credits to be earned for awarding degree
In plant Training / Internship	-	-	√	√	√	√	√	-	**1**
Industry Supported Course	-	-	√	√	√	√	√	-	**0**
Mandatory courses (MC)	√	√	-	√	-	√	-	-	**7**
Online Courses (PE)	-	-	√	√	√	√	√	-	**0**

SYLLABUS FOR FIRST SEMESTER SUBJECTS

191LEH101T	TECHNICAL ENGLISH	L	T	P	R	C
		3	0	0	0	3

(Common to all branches of Engineering and Technology)

OBJECTIVE:

- To develop the basic writing skills of the First year Engineering students.
- To help learners develop their listening skills, which will, enable them to listen to lectures and enhance their ability to comprehend by asking questions and seeking clarification.
- To help learners develop their speaking skills and help them to speak fluently.
- To inculcate reading habit and to develop effective reading skills.
- To help students improve their active and passive vocabulary.

UNIT I **9 Hours**

Short comprehension passages – skimming, scanning, predicting and inference of the passage – Tips for effective writing –Hints development – Purpose of a good conversation – Tips for improving Conversation – Active and Passive listening – Types of listening – Barriers to listening – listening for specific purposes – Listening to lectures and note taking - Parts of Speech - Tenses – WH Questions – Yes/No questions – Prefixes and Suffixes – Word formation.

UNIT II **9 Hours**

Longer Comprehension passages - Questions – multiple choice –short questions – open-ended questions – Sentence structure - Types of paragraph – Short narrative paragraphs- Comparison and contrast – argumentative paragraph – analytical paragraph – Techniques for writing precisely - Introducing your friend – Exchange information – Expressing opinion/ agreeing /disagreeing **-** Telephonic conversation - If Clause – Subject verb agreement – degrees of comparison – Pronouns - adverbs.

UNIT III **9 Hours**

Short texts – Cloze passage guessing from context – Note making – Use of reference words – Discourse markers – Connectives – Jumbled sentences –Product description–Process description - Prepositions - Direct/Indirect speech – Connotations – One word substitution – Idiomatic expressions.

UNIT IV **9 Hours**

Different types of texts – Newspapers/ magazines/short stories - Inference – Tips for effective writing – Letter writing – Letter to the Editor - Speaking about oneself/ hometown – Review of books – listening to native speakers – American accent and neutral accent - Countable/Uncountable nouns – Articles – Synonyms and Antonyms – Phrasal verbs.

UNIT V **9 Hours**

Reading for specific purpose – Short essays – developing an outline –Group discussion – Giving advice – Modal verbs – Instructions and Recommendations - Collocations.

TOTAL: 45 HOURS

COURSE OUTCOMES:

1. Listen, Understand and Respond to others in different situations.
2. Speak correctly and fluently in different situations using appropriate communication strategies.
3. Read and Comprehend a range of texts adopting different reading skills.
4. Write with clarity in simple, apt and flawless language with coherence and cohesion.
5. Use their communicative competency with purpose and clarity in the context of Science and Technology.

TEXTBOOKS

1. Sanjay Kumar, Pushp Lata. English Language and Communication Skills for Engineers, Oxford University Press 2018

REFERENCE BOOKS

1. Bailey, Stephen. Academic Writing: A practical guide for students. New York: Rutledge, 2011.
2. Dutt P. Kiranmai and Rajeevan Geeta. Basic Communication Skills, Foundation Books: 2013
3. Means,L. Thomas and Elaine Langlois. English & Communication for Colleges. Cengage Learning USA: 2007

WEBSITES:

https://www.usingenglish.com
http://grammarbook.com

JOURNALS:

National Council for Teachers of English
https://www2.ncte.org/resources/journals/college-english/

EXTENSIVE READER:

Spencer Johnson, Who Moved My Cheese, Putnam Adult, 1998

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191MAB101T	ENGINEERING MATHEMATICS - I	L	T	P	R	C
		3	2	0	0	4

(Common to all branches of Engineering and Technology)

UNIT I : MATRICES **12 Hours**

Overview of system of Linear Equations - Eigen values and Eigen vectors of a real matrix – Characteristic equation – Properties of Eigen values and Eigen vectors – Cayley-Hamilton theorem – Diagonalization of matrices – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms.

UNIT II : DIFFERENTIAL CALCULUS **12 Hours**

Limit of a function - Continuity - Derivatives – Differentiation Rules – Mean Value Theorem – Interval of increasing and decreasing functions – Maxima and Minima - Interval of concavity and convexity –Taylor's Series for one variable.

UNIT III: MULTIVARIABLE CALCULUS **12 Hours**

Limits and Continuity – Partial derivatives – Total derivative – Differentiation of implicit functions – Jacobian and properties – Taylor's series for functions of two variables – Maxima, minima and saddle points - Method of Lagrange multipliers.

UNIT IV : INTEGRAL CALCULUS **12 Hours**

Definite Integrals and its properties –Fundamental theorem of Calculus - Techniques of integration for Indefinite Integrals using basic integration formulas – Integration by parts – Trigonometric Substitutions – Integration of Rational functions by Partial Fractions.

UNIT V : MULTIPLE INTEGRATION **12 Hours**

Double integrals – Change the order of integration in double integrals - Change of variables (Cartesian to polar) - Applications: areas and volumes - Triple integrals (Cartesian, Cylindrical and Spherical coordinates).

TOTAL: 60 HOURS

COURSE OUTCOMES:

The Course aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

The students will learn:

1. To express large amounts of data and functions in an organized and concise form apart from diagonalizing matrices.
2. To solve maxima and minima problems using differentiation.

3. Apply functions of several variables to solve problems in engineering and technology.
4. To evaluate integrals by using Fundamental Theorem of Calculus.
5. Apply integration to compute multiple integrals, area, volume, integrals in polar coordinates, in addition to change the order and change of variables.

TEXT BOOKS:

1. Joel Hass, Christopher Heil and Maurice D.Weir "Thomas' Calculus", 14th Edition, Pearson.
2. Grewal B.S., - Higher Engineering Mathematics, Khanna Publishers, New Delhi, 43rd Ed., 2014.

REFERENCE BOOKS:

1. Bali N.P.and Manish Goyal " Engineering Mathematics" (For Semester I) Third Edition, University Science Press.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, John Wiley & Sons.
3. Fritz John and Richard Courant, "Introduction to Calculus and Analysis" Springer.
4. James Stewart, "Calculus: Early Transcendental", Cengage Learning, 7th Edition, New Delhi, 2015.
5. Veerarajan T., Engineering Mathematics, Tata McGraw-Hill, New Delhi.

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191PYB101T	ENGINEERING PHYSICS	L	T	P	R	C
		3	0	0	0	3

(Common to all branches of Engineering and Technology)

OBJECTIVES:

To enhance the fundamental knowledge in Physics and its applications relevant to various streams of Engineering and Technology.

UNIT I : PROPERTIES OF MATTER **9 Hours**

Stress - Strain relationship, Hooke's law, Elastic moduli, Stress - Strain diagram for various engineering materials, Ductile and Brittle materials - Torsional pendulum – Beam, Expression for bending moment - Cantilever, Uniform and Non-uniform bending, Theory and Experimental determination of Young's modulus.

UNIT II : SOUND WAVES AND VIBRATIONS **9 Hours**

Propagation, Intensity, Loudness of sound waves – Determination of absorption coefficient, Reverberation, Sabine's formula for reverberation time - Factors affecting acoustics of buildings and their remedies - Acoustic Quieting: Aspects, Methods, Quieting for Specific observers, Mufflers, Soundproofing - Ultrasonic waves and properties, Methods of Ultrasonic production, Applications of Ultrasonic in engineering and medicine.

UNIT III : THERMAL PHYSICS **9 Hours**

Fundamentals of thermal energy – Expansion joints - Bimetallic strips - Thermal conductivity, conductions in solids, Differential equation of one dimensional heat flow- Forbe's and Lee's disc method - Conduction through compound media – Thermal insulation – thermal shock resistance - Applications: Solar water heater- tempered glass- cryogenic materials.

UNIT IV : QUANTUM MECHANICS **9 Hours**

Inadequacies of Classical Mechanics – Black body radiation- Planck's theory of radiation - Dual nature of electromagnetic radiation – De Broglie hypothesis for matter waves – Heisenberg's uncertainty principle – Schrodinger's time dependent and independent wave equation, significance of wave function - Born interpretation - Particle confinement in 1D box.

UNIT V : APPLIED OPTICS **9 Hours**

Spontaneous and Stimulated emission - Einstein co-efficients (derivation) – Spatial and Temporal coherence – Schawlow-Townes condition for population inversion (Qualitative study) - Types of lasers – Nd:YAG, Semiconductor - Applications of Laser in science, engineering and medicine. Principle and propagation of light in optical fibre, Derivation for Numerical

aperture and Acceptance angle - Types and losses of optical fibre - Fibre Optical Communication (Block diagram) - Active and Passive sensors - Medical endoscope.

TOTAL: 45 HOURS

COURSE OUTCOMES:

At the end of this course,

1. The students will gain knowledge on the basics of properties of matter and its applications,
2. The students will acquire knowledge on the concepts of sound waves and vibrations.
3. The students will have adequate knowledge on the concepts of thermal properties of materials and their applications in expansion joints and solar water heaters,
4. The students will get knowledge on advanced physics concepts of quantum theory,
5. The students will acquire knowledge on the concepts of optical devices and their applications in fibre optics.

TEXT BOOKS

1. Bhattacharya D.K & T.Poonam, **Engineering Physics ,** Oxford University Press, 2015.
2. Pandey B.K.& S.Chaturvedi, **Engineering Physics**, Cengage Learning India, 2012.
3. Senthilkumar, G.**Engineering Physics I**, VRB Publishers, 2011.

REFERENCES

1. Aruldhas G, **Quantum Mechanics,** PHI Learning Pvt. Ltd.,New Delhi, 2011.
2. Arthur Beiser,**Concepts of Modern Physics, 6**th edn.,McGraw Hill 2003.
3. Gaur R.K & S.L.Gupta, **Engineering Physics**, Dhanpat Rai Publishers, 2012.
4. Halliday D, R.Resnick & J.Walker, **Principles of Physics**, Wiley, 2015.
5. Serway R.A & J.W.Jewett, **Physics for Scientists and Engineers**, Cengage Learning, 2010.
6. Tipler P.A & G.Mosca, **Physics for Scientists and Engineers with Modern Physics**, W.H.Freeman, 2007.
7. Zeemansky M.W and R.H.Dittman, **Heat and Thermodynamics**, 8th edn., Mc.Graw Hill, NewYork, 2017.

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191CYB101T	ENGINEERING CHEMISTRY	L	T	P	R	C
		3	0	0	0	3

(Common to all branches of Engineering and Technology)

OBJECTIVES:

- To make the students conversant with boiler feed water requirements, related problems and water treatment techniques.
- To get the basic idea about the polymers and applications of polymers and polymer reinforced composites.
- It deals with the information about the types of fuels, calorific value calculationsand manufacture of solid, liquid and gaseous fuels.
- It enable the students to gain information about Principles and generation of energy in batteries, nuclear reactors, solar cells, wind mills and fuel cells
- To impart knowledge about the nanomaterials synthesis, properties and applications

UNIT I - Water Treatment and Technology **9 Hours**

Introduction – characteristics - alkalinity - types and determination – hardness – types only -boiler feed water-requirements-boiler troubles – scale & sludge -disadvantages (wastage of fuels, decrease in efficiency, boiler explosion) - softening of hard water - external treatment process - demineralization and zeolite, internal treatment - boiler compounds (phosphate, calgon, carbonate and colloidal conditioning methods) – desalination of brackish water –reverse osmosis.

UNIT II – Polymers and Reinforced plastics **9 Hours**

Introduction- classification of polymers - Natural and synthetic - Thermoplastic and Thermosetting, Functionality-Degree of polymerization,types - addition and condensation polymerization – free radical polymerization mechanism - Preparation, properties and uses of PVC, Nylon 6,6, Teflon and Epoxy resin. Plastics - Compounding of plastics – moulding methods –injection, extrusion and compression – FRP – carbon and glass – applications.

UNIT III- Fuels and combustion **9 Hours**

Classification - Coal – proximate and ultimate analysis, - carbonization -metallurgical coke –manufacture by Otto Hoffmann method – petroleum – refining - cracking -synthetic petrol by Bergius process - knocking in petrol and diesel engines- octane and cetanerating of fuels-synthesis – advantages and commercial application of power alcohol and biodiesel- Gaseous fuels- liquefied petroleum gases (LPG)- compressed natural gas (CNG)- Combustion of fuels:Introduction - calorific value–higher & Lower- theoretical calculation - Flue gas analysis by Orsat method.

UNIT IV – Energy Sources and Storage Devices **9 Hours**

Energy – Types – Non-renewable energy - Nuclear energy –fission and fusion reactions - differences between nuclear fissionand fusion - nuclear chain reactions - light water nuclear reactor for power generation – breeder reactor – renewable energy - solar energy conversion - solar cells - wind energy

Electrochemical cells – reversible and irreversible cells –Cell construction and representation - Batteries -types of batteries – characteristics – construction and working of primary battery (dry cell) - secondary battery (lead acid battery and lithium-ion-battery) - fuel cells (H_2-O_2)

UNIT V – Concepts of Nano chemistry and Green chemistry **9 Hours**

Nano chemistry introduction – basics –general properties - distinction between nanoparticles, molecules and bulk materials–size-dependent properties. Synthesis: precipitation, thermolysis, hydrothermal, solvothermal, electro deposition, chemical vapour deposition, laser ablation - properties of nanoparticles – Types of Nanoparticles:nano cluster, nano rod, nanowire and nano tube – Carbon Nano Tube (Synthesis, properties and applications) – applications of nanoparticles.

Green chemistry introduction - Principles - Applications

Total : 45 HOURS

COURSE OUTCOMES:

1. The knowledge gained on water treatment techniques will facilitate better understanding of engineering processes and applications for further learning.
2. The knowledge gained on water treatment techniques will facilitate better understanding of engineering processes and applications for further learning.
3. Students can get knowledge about various fuels and its applications based on its calorific value.
4. It provides the students to understand about conventional and non-conventional energy sources and its applications
5. It provides the students to gain knowledge about the recent trentds in nano materials.

Text Books:

1. Kannan P and Ravikrishnan A, “Engineering Chemistry”, Sri Krishna, Hitech publishing Company Pvt. Ltd, 2014
2. Jain P.C. and Monika Jain, “Engineering Chemistry” Dhanpat Rai, Publishing Company (P) Ltd.,New Delhi, 2015.

Reference Books:

1. Dara S.S &S.S Umare, “A Text book of Engineering Chemistry”, S.Chand & Company Ltd., New Delhi, 2015.
2. Palanna O.G, “Engineering Chemistry”, McGraw Hill Education (India)Pvt. Ltd, Chennai,2017
3. Vairam S ,P. Kalyani and Suba Ramesh., “Engineering Chemistry”,Wiley India PVT, Ltd, New Delhi, 2013.

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191GES101T	ENGINEERING GRAPHICS	L	T	P	R	C
		2	0	4	0	4

(Common to all branches of Engineering and Technology)

OBJECTIVES:

- To develop students, graphic skills for communication of concepts, ideas and design of engineering products.
- To expose them to existing National standards related to technical drawings.
- To Familiarize with basic geometrical constructions and orthographic projections.
- To make the students to draw the different projections of the solids.
- To view the true shape and apparent shape of the sectioned solids and their developments.
- To get an idea about 3D views through isometric projections.

UNIT 0 : CONCEPTS AND CONVENTIONS USED **2 Hours**

Principles of Engineering graphics and their significance - Use Of drawing Instruments-BIS conventions and specifications-Size, Layout and folding of drawing sheets-Lettering and Dimensioning.

UNIT I:PLANE CURVES, PROJECTION OF POINTS **17 Hours**

Conic Sections - Construction of Ellipse, Parabola & hyperbola by eccentricity method – Construction of cycloid – Introduction to Scales. Introduction of Orthographic projection - Principal planes - First angle projection - projection of points.

UNIT II: PROJECTION OF LINES AND PLANES **17 Hours**

Projection of straight lines inclined to both the principal planes by rotating line method. Projection of simple planes inclined to both the principal planes by rotating object method.

UNIT III: PROJECTION OF SOLIDS **17 Hours**

Projection of simple solids like Prism, Pyramid, Cylinder & Cone when the axis is inclined to one of the principal planes by rotating object method.

UNIT IV: SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES **17 Hours**

Sectioning of simple solids (Prism, Pyramid, Cylinder & Cone) in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of surfaces of right regular and sectioned solids.

UNIT V: ISOMETRIC AND ORTHOGRAPHIC PROJECTIONS **17 Hours**

Principles of Isometric projections-Isometric scale- Isometric Views of simple and truncated solids – combination of two solid objects in simple vertical positions. Conversion of Isometric views to Orthographic views of the objects.

UNIT VI: COMPUTER AIDED DRAFTING :(Demonstration Only, Not for Exam**)** **3 Hours**

The Concepts of Computer Aided Drafting for Engineering drawing, Computer graphics & Geometrical modeling (2D Orthographic Views) and 3D drafting (Isometric Views) using AutoCAD.

TOTAL : 90 HOURS

COURSE OUTCOMES:

On successful completion of this course, the student will be able to

1. Familiarize with the fundamentals and standards of Engineering graphics
2. Perform basic geometrical constructions and principles of orthographic projections.
3. Project orthographic projections of lines and plane surfaces.
4. Draw projections of solids and development of surfaces.
5. Visualize and to project isometric views and conversion of Isometric views to Orthographic views.
6. Understand the basics of AUTO CAD and fundamentals of perspective projections.

TEXT BOOKS :

1. Natarajan K.V., "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2009.
2. Jayapoovan T, "Engineering Graphics using AUTOCAD", Vikas Publishing ,7 th Edition.
3. Venugopal K. and Prabhu Raja V., "Engineering Drawing with AUTOCAD and building drawing", New Age International (P) Limited, 2018, 5TH edition.

REFERENCES:

1. Basant Agarwal and Agarwal C.M., "Engineering Drawing", Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.
2. Bhatt N.D. and Panchal V.M., "Engineering Drawing", Charotar Publishing House, 50th Edition, 2010.
3. Dinesh Kumar S, K.Sivakumar and R.Ramadoss, " Engineering Graphics", Maruthi Publishers, Chennai,2019.
4. Gopalakrishna K.R., "Engineering Drawing" (Vol. I&II combined), Subhas Stores, Bangalore, 2007.
5. Parthasarathy N S and Vela Murali, "Engineering Graphics", Oxford University, Press, New Delhi, 2015.
6. Shah M.B., and Rana B.C., "Engineering Drawing", Pearson, 2nd Edition, 2009.

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191GES102T PROBLEM SOLVING THROUGH PYTHON PROGRAMMING

L	T	P	R	C
3	0	0	0	3

(Common to all branches of Engineering and Technology)

OBJECTIVES :

The course on Python Programming is intended to enhance the computational and logical thinking of students. Upon completion of the course, the students would be able to master the principles of Python programming and demonstrate significant experience in problem solving.

UNIT I : ALGORITHMIC PROBLEM SOLVING **9 Hours**

Algorithms, building blocks of algorithms (statements, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Case study: Towers of Hanoi, insertion sort, guess an integer number in a range.

UNIT II : CONTROL FLOW STATEMENTS **9 Hours**

Python interpreter, interactive mode and script mode; variables, expressions, statements; values and data types; Operators and Precedence of operators, comments; Conditionals: conditional, alternative, chained conditional, nested conditional; Iterations: while, for, break, continue.

UNIT III : FUNCTIONS AND STRINGS **9 Hours**

Modules and functions: function definition and use, flow of execution, parameters and arguments; Fruitful functions: return values, composition, recursion; Strings: string slices, immutability, Looping and counting, String methods.

UNIT IV : LIST, TUPLE AND DICTIONARIES **9 Hours**

Lists: list operations, list slices, list methods, traversing, mutability, aliasing, list arguments, list comprehension; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and functions, Looping and dictionaries, histogram.

UNIT V : FILES, EXCEPTIONS **9 Hours**

Files: text files, reading and writing files, format operator, filenames and paths; Exceptions: handling exceptions, multiple exception blocks, finally block; Case study: tkinter.

TOTAL: 45 HOURS

COURSE OUTCOMES:

Upon completion of the course, the students would be able to

1. Design solutions to simple computational problems
2. Read, write and execute Python programs.
3. Decompose a Python program into functions
4. Implement compound data using Python lists, tuples, and dictionaries.
5. Read and write data from/to files in Python Programs.
6. Understand the GUI concepts and implement in Python.

TEXT BOOKS:

1. Allen B. Downey, ``Think Python: How to Think Like a Computer Scientist'', Version 2.0.17 edition, Updated for Python 3, Shroff/O'Reilly Publishers, (http://greenteapress.com/wp/thinkpython/)
2. Reema Thareja "Python Programming using Problem solving Approach", Oxford University Press.

REFERENCES:

1. Paul Gries, Jennifer Campbell and Jason Montojo, ¯Practical Programming: An Introduction to Computer Science using Python 3‖, Second edition, Pragmatic Programmers, LLC, 2013.
2. Robert Sedgewick, Kevin Wayne, Robert Dondero, ¯Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.
3. Timothy A. Budd, ¯Exploring Python‖, Mc-Graw Hill Education (India) Private Ltd. 2015.

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191GEB111L	PHYSICS AND CHEMISTRY LABORATORY	L	T	P	R	C
		0	0	4	0	2

(Common to all branches of Engineering and Technology)

(A) PHYSICS LABORATORY

OBJECTIVE

The purpose of this course is to develop scientific temper in experimental techniques and to reinforce the physics concepts among the engineering students

INSTRUCTIONAL OBJECTIVES

1. To gain knowledge in the scientific methods and learn the process of measuring different Physical variables
2. Develop the skills in arranging and handling different measuring instruments
3. Get familiar on experimental errors in various physical measurements and to plan/ suggest on how the contributions could be made of the same order, so as to minimize the errors.

ANY FIVE EXPERIMENTS

1. Torsion Pendulum – Rigidity modulus of wire and moment of inertia of disc.
2. Non Uniform Bending – Young's modulus determination.
3. Spectrometer – Wave length of spectral lines using grating.
4. Lee's Disc – Thermal Conductivity of bad conductor.
5. Semiconductor Laser –Wavelength of laser light, Size of particle and Numerical aperture of optical fiber.
6. Air Wedge – Measurement of thickness of thin wire.
7. Determination of the Band gap of a semiconductor.
8. Ultrasonic Interferometer - Velocity of sound and Compressibility of liquid.

TOTAL: 30 HOURS

TEXT BOOKS

1. G.Rajkumar, **Physics laboratory Practical**, McGraw Hill publication, 2019.
2. R.K.Shukla and Anchal Srivastava, **Practical Physics**, 1st Edition, New Age International (P) Ltd, New Delhi, 2006.
3. Physics Laboratory Manual, Faculty Members, Department of Physics, Easwari Engineering College, Chennai.

REFERENCES

1. Chattopadhyay D, P.C.Rakshit and B.Saha, **An Advanced Course in Practical Physics**, 2nd ed., Books & Allied Ltd., Calcutta, 1990.
2. Souires G L , **Practical Physics**, 4th Edition, Cambridge University, UK, 2001.

(B) CHEMISTRY LABORATORY

OBJECTIVES:

- To make the student to acquire practical skills in the determination of water quality parameters.
- To acquaint the students with the determination of molecular weight of polymer by using viscometer.

Any Five Experiments

1. Determination of chloride content of water sample by Argentometric method
2. Determination of strength of given HCl using pH meter
3. Determination of strength of acid in a mixture using conductivity meter.
4. Determination of permanent, total and temporary hardness of water sample.
5. Estimation of Fe^{2+} by Potentiometric titration
6. Determination of molecular weight of PVA using Ostwald viscometer
7. Determination of alkalinity in water sample
8. Estimation of Iron content in water sample using spectrophotometer (1,10 – Phenanthroline/thiocyanate method)
9. Conductometric titrations of strong acid Vs strong base
10. Determination of DO Content of water sample by Wrinkles method
11. Determination of BOD and COD in water sample

TOTAL: 30 HOURS

COURSE OUTCOMES:

- The students will be outfitted with hands-on knowledge in the quantitative chemical analysis of water quality related parameters.

REFERENCES:

1. Dr. C. Ravichandran, “Engineering Chemistry Laboratory-I” Global publications, 2019.
2. Furniss B.S. Hannaford A.J, Smith P.W.G and Tatchel A.R., “Vogel’s Textbook of practical organic chemistry, LBS Singapore (1994).
3. Jeffery G.H, Bassett J., Mendham J. and Denny R.C., “Vogel’s Text book of quantitative analysis chemical analysis”, ELBS 5th Edn. Longman, Singapore publishers, Singapore, 1996.
4. Daniel R. Palleros, “Experimental organic chemistry” John Wiley & Sons, Inc.,New York (2001).

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191GES111L	PYTHON PROGRAMMING LABORATORY	L	T	P	R	C
		0	0	3	1	2

(Common to all branches of Engineering and Technology)

OBJECTIVE:

The course on Python programming laboratory is used to write, test and debug simple Python programs. Upon completion of the course, the students would be able to master the concepts of data types, loops, functions, list, tuples, dictionary , files and GUI.

LIST OF PROGRAMS:

1. LCM of two numbers.
2. Sum of squares of first n natural numbers
3. Fibonacci series.
4. Armstrong number
5. Sum of Digits in a Number.
6. First n prime number.
7. Factorial of a number using recursion
8. Count the number of vowels in a string
9. Matrix multiplication.
10. Simple calculator
11. Linear search
12. Selection sort
13. Insertion sort
14. Word count.
15. Mini Project (any ONE): Design GUI for
    - Airline reservation system
    - Feedback system
    - Employee management system
    - Student management system
    - Banking system

TOTAL: 60 HOURS

COURSE OUTCOMES:

Upon completion of the course, the students would be able to

1. Write, test, and debug simple Python programs.
2. Implement Python programs with conditionals and loops.
3. Use functions for structuring Python programs.
4. Represent compound data using Python lists, tuples, dictionaries.
5. Read and write data from/to files in Python
6. Design GUI applications.

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SYLLABUS FOR SECOND SEMESTER SUBJECTS

191LEH201T	PROFESSIONAL COMMUNICATION	L	T	P	R	C
		3	0	0	0	3

(Common to all branches of Engineering and Technology)

OBJECTIVES:

- To strengthen their listening skills which help them comprehend lectures and talks in their areas of specialization
- To develop their speaking skills to make technical presentations, participate in Group Discussions.
- To develop strategies and skills to enhance their ability to read and comprehend engineering and technology texts.
- To foster their ability to write convincing job applications
- To equip with appropriate skills for writing effective reports.

UNIT I **9 Hours**

Communication – Process of Communication – Different forms of communication – Communication flow- Barriers of communication - Purpose and Function expressions – Extended definitions – Cause and Effect expressions - Compound nouns- Homonyms/homophones

UNIT II **9 Hours**

Listening to technical talks - Body language pertaining to Presentation- countering stage fright – Preparing PPT for presentation – Interpreting charts/graphs/pie charts/ bar diagram/tabular column/ tree diagram – Words often confused – Active/ Passive/ Impersonal Passive Voice – Numerical adjectives.

UNIT III **9 Hours**

Etiquette of Group discussion – discussing GD topics - reading journals and paraphrasing – Report Writing – Accident report/- Industrial visit report – Words often Misspelt – Describing a process using sequence words – Words used as different parts of speech

UNIT IV **9 Hours**

Small talk – review on films and books – email etiquette - Cover letter & Resume – Calling for quotations – Placing order – Letter of complaint - escalation letter - Feasibility report - Project report – - Abbreviations and Acronyms pertaining to Science and Technology – Types of Essays - Argumentative, Analytical, Descriptive & Expository.

UNIT V **9 Hours**

Writing Statements of Purpose-format, Sample – Modifiers, Redundancies-Direct indirect speech-Project Proposal – Minutes of Meeting - Verbal Analogies – Case studies relating to Goal Setting- Writing articles

TOTAL: 45 HOURS

COURSE OUTCOMES:

1. Learners can draft effective formal letters and emails.
2. Listen and comprehend different technical/non-technical excerpts critically and infer the implied meaning.
3. Write ungrammatically and help in organizing ideas logically on a topic using a wide range of vocabulary
4. Read different genres of texts and evaluate them for content and structure.
5. Be proactive in using the language confidently and effectively for personal and professional growth.

TEXTBOOKS

2. Raymond Murphy, English Grammar in Use: Reference and Practice for Intermediate Students, Cambridge : CUP, 2004

REFERENCE BOOKS

1. M. Ashraf Rizvi 'Effective Technical Communication', Tata McGraw-Hill, New Delhi, 2005
2. Richard Johnson - Sheehan, Technical Communication Today, Longman Publishing Group, 2011
3. Golding S.R. 'Common Errors in English Language', Macmillan, 1978

WEBSITES:

https://owl.purdue.edu
https:www.hellolingo.com

JOURNALS:

IEEE/transactions on Professional Communication
https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=47

EXTENSIVE READER:

Stephen R. Covey, The Seven Habits of Highly Effective People, Free Press, 1989

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191MAB201T	ENGINEERING MATHEMATICS - II	L	T	P	R	C
		3	2	0	0	4

(Common to all branches of Engineering and Technology)

OBJECTIVES :

- The objective of this course is to familiarize the prospective engineers with techniques in ordinary differential equations, complex variables and complex integration.
- The Study of Laplace transform help to solve the differential equations that occur in various branches of engineering disciplines.
- Vector calculus can be widely used for modelling the various laws of physics.
- The various methods of complex analysis can be used for efficiently solving the problems that occur in various branches of engineering disciplines.

UNIT 1: ORDINARY DIFFERENTIAL EQUATIONS **12 Hours**

Basic concepts - Separable differential equations - Exact differential equations - Integrating factors - Linear differential equations – Second order linear differential equations with constant coefficients – Particular Integral using operator method and Method of variation of parameters – Homogenous equation of Euler's and Legendre's type.

UNIT 2: LAPLACE TRANSFORMS **12 Hours**

Existence conditions – Transforms of elementary functions –Transform of unit step function and unit impulse function – Basic properties – Shifting theorems -Transforms of derivatives and integrals – Transform of periodic functions - Inverse transforms: Convolution theorem (Statement only) and Partial Fractions - Application to solution of linear second order ordinary differential equations with constant coefficients.

UNIT 3: VECTOR CALCULUS **12 Hours**

Gradient and directional derivative – Divergence and curl – Irrotational and Solenoidal vector fields – Line integral – Surface integral - Area of a curved surface - Green's, Gauss divergence and Stokes' theorems in evaluating line, surface and volume integrals (Planar, Cylindrical and Spherical Surfaces).

UNIT 4 : COMPLEX VARIABLES **12 Hours**

Analytic functions – Necessary and sufficient conditions for analyticity in Cartesian form - Properties – Harmonic conjugates – Construction of analytic function – Conformal mapping – Mapping by function

$w = z + c,\ cz,\ \frac{1}{z},\ z^2$ - Bilinear transformation.

UNIT 5 : COMPLEX INTEGRATION **12 Hours**

Complex integral - Cauchy's integral theorem – Cauchy's integral formula – Taylor's and Laurent's series – Singularities – Residues – Residue theorem – Application of residue theorem for evaluation of real integrals – Use of circular contour and semicircular contour (No poles on the real axis).

TOTAL: 60 HOURS

TEXT BOOKS:

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43rd Edition, 2014.
2. Joel Hass, Christopher Heil and Maurice D.Weir Thomas' Calculus , 14th Edition, Pearson.

REFERENCE BOOKS:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons.
2. N.P.Bali and Manish Goyal " Engineering Mathematics"(For Semester II) Third Edition, University Science Press .
3. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi.
4. O'Neil, P.V. "Advanced Engineering Mathematics", Cengage Learning India Pvt., Ltd, New Delhi, 2007 .
5. James Stewart, "Calculus: Early Transcendentals", Cengage Learning, 7th Edition, New Delhi, 2015.

COURSE OUTCOMES:

The Course aims to equip the students to deal with advanced level of mathematics and applications that would be essential for their disciplines.

The students will learn:

1. The effective mathematical tools to obtain the solutions of first and second order differential equations that model physical processes.
2. Gradient, divergence and curl of a vector point function and related identities. Evaluation of line, surface and volume integrals using Gauss, Stokes and Green's theorems and their verification.
3. The tools of differentiation and integration of functions of a complex variable that are used in various techniques dealing engineering problems.
4. Analytic functions, conformal mapping and complex integration.
5. Laplace transform and inverse transform of simple functions, properties, various related theorems and application to solve the differential equations with constant coefficients.

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191GES201T BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

L	T	P	R	C
3	0	0	0	3

(Common to first year Automobile, Biomedical, Civil, CSE, Mechanical, R&A, AI&DS and IT)

OBJECTIVES:

1. To understand the Basic Fundamentals in Electrical Circuits.
2. To study the construction, Principle of operation and performance of DC and AC Machines
3. To understand the principles of PN Junction diode and BJT
4. To Study the protection and safety measures in Electricity

UNIT I FUNDAMENTALS OF ELECTRICITY AND CIRCUITS: **9 Hours**

Evolution of Electricity and Inventions- Electrical Quantities–Charge- Electric Potential, Voltage, Current, Power Energy, DC, AC, time period, Frequency, Phase, Flux density, RMS, Average, Peak, Phasor and Vector diagram. Electric circuit elements – Sources - Ohm's Law - Kirchhoff's Laws, Faradays Law, Lenz's Law- Wiring- House wiring and Industrial Wiring systems.

UNIT-II MEASURING INSTRUMENTS: **9 Hours**

Principle of Operation Moving Coil and Moving Iron Types of Voltmeters and Ammeters - Multimeters -Measurements of resistance, inductance & capacitance-Power and Energy Measurements- Energy Efficient Equipment's and sample load (Domestic load) calculations.

UNIT III ELECTRICAL MACHINES: **9 Hours**

Construction - Principle of Operation - EMF Equation -Application of DC Generator, DC Motor – types and Characteristics – Applications – Transformer-AC Machines – Construction, Operation and types of Single phase and three Phase Induction Motors.

UNIT IV BASIC ELECTRONICS AND COMMUNICATION: **9 Hours**

PN Junction Diode, Zener Diode – V-I Characteristics – Applications – Rectifier – Half Wave – Full Wave and Rectifiers – Transistors types – Transistor as an Amplifier – Junction Field Effect Transistor (JFET) operation and characteristics, SCR - characteristics and its applications- CRO-Principle of Cathode Ray Tube-regulated power Supply- Function Generators. Communication systems- types- Analog, Digital and Wireless.

UNIT V PROTECTION, SAFETY AND INDIAN ELECTRICITY SCENARIO: **9 Hours**

Hazards of Electricity-Shock, Burns, arc- blast, Thermal Radiation, Explosives, fires, effect of electricity on the human Body. Electrical safety practices, Protection devices. Electrical power- Generation resources- transmission and Distribution. Regulatory authorities- role of MNRE, MNRE, NTPC, TEDA, TANGEDCO.

TOTAL : 45 HOURS

COURSE OUTCOMES:

1. Demonstrate knowledge on basics of electrical circuits, Construction and working principle of various electrical machines.
2. Analyze the behaviour and performance of electrical circuits and machines.
3. Apply knowledge on CRO and function generator.
4. Describe electrical hazards and safety equipment.
5. Analyze and apply various grounding and bonding techniques.
6. Select appropriate safety method for low, medium and high voltage equipment.
7. Participate in a safety team.
8. Carry out proper maintenance of electrical equipment by understanding various standards.

TEXT BOOKS:

1. S.Hasan Saeed, D.K.Sharma, Non-Conventional Energy Resources, Katson Books, 3rd Edition, 2013
2. John Cadick, Mary Capelli-Schellpfeffer, Dennis Neitzel, Al Winfield,'Electrical Safety Handbook', McGraw-Hill Education, 4thEdition, 2012.
3. D.P.Kothari and I.J. Nagarath –"Basic Electrical & Electronics Engineering", Mc.Grawhill publications, 1st Edition, 2014.
4. Leonard S Bobrow, "Foundations of Electrical Engineering", Oxford University Press, 2013
5. Vincent Del Toro, Electrical Engineering Fundamentals, Prentice Hall, 2006.

References:

1. Del Toro, "Electrical Engineering Fundamentals", Pearson Education, New Delhi, 2007 2. John Bird, "Electrical Circuit Theory and Technology", Elsevier, First Indian Edition, 2006.
2. Maxwell Adams.J, 'Electrical Safety- a guide to the causes and prevention of electric hazards', The Institution of Electric Engineers, IET 1994. 2. Ray A. Jones, Jane G. Jones, 'Electrical Safety in the Workplace', Jones & Bartlett Learning, 2000.
3. V.K.Mehta& Rohit Mehta, Principles of Electrical Engineering, S.Chand publications, 2nd Edition, 2003.
4. Lawmans, Electricity act 2003, Act No. 36 of 2003, Kamal Publishers, New Delhi.

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191GES202T	ENGINEERING MECHANICS	L	T	P	R	C
		3	2	0	0	4

(Common to first year Automobile, Biomedical, Civil, Mechanical and R&A Engineering)

OBJECTIVES:

- To apply the fundamental concepts in determining the effect of forces on a particle and rigid body.
- To determine the geometry dependant properties of solids and sections
- To apply the principles of kinetics and kinematics in dynamics
- To understand the concepts of static friction.
- To know the basics of solid mechanics.

UNIT I STATICS OF PARTICLES **12 Hours**

Introduction – Units and Dimensions – Laws of Mechanics – Lami's theorem, Parallelogram and triangular Law of forces – Vectorial representation of forces – Vector operations of forces - Coplanar Forces – Resolution and Composition of forces – Free body diagram - Forces in space – Equilibrium and equivalent system of forces in space – Principle of transmissibility.

UNIT II EQUILIBRIUM OF RIGID BODIES **12 Hours**

Free body diagram – Types of supports –reaction forces –stable equilibrium –- Moments and Couples – Vectorial representation of moments and couples – Varignon's theorem – Single equivalent force - Resultant and equilibrium - Equilibrium of Rigid bodies in two and three dimensions - Analysis of truss elements – method of joints.

UNIT III PROPERTIES OF SURFACES AND SOLIDS **12 Hours**

Centre of gravity, Centre of mass and Centroid – Moment of Inertia of simple and complex areas -Theorems of Pappus - Area moments of inertia of plane areas -Parallel axis theorem and perpendicular axis theorem – Principal moments of inertia of plane areas – Radius of gyration – Polar moment of inertia – Product of inertia - Mass moment of Inertia of simple solids.

UNIT IV DYNAMICS OF PARTICLES AND FRICTION **12 Hours**

Kinematics – Rectilinear and curvilinear motion – projectile motion Kinetics – Newton's second law – D'Alembert's Principle – Work Energy method – Principle of Impulse momentum – Laws of friction – coefficient of friction – Dry friction – wedge friction – ladder friction – rolling resistance

UNIT V STRESS, STRAIN AND DEFORMATION OF SOLIDS **12 Hours**

Stresses - Strain - - Hooke's law-Relationship among elastic constants- Factor of safety-Thermal stresses- Compound bars- Strain energy due to axial force, impact and suddenly applied load.

TOTAL: 60 HOURS

COURSE OUTCOMES:

On successful completion of this course, the student will be able to

1. Analyse the particle and rigid body in equilibrium
2. Evaluate the properties of surfaces and solids
3. Calculate dynamic forces exerted in rigid body
4. Determine the friction and the effects by the laws of friction
5. Understand the properties of deformable solids

TEXT BOOKS:

1. Beer, F.P and Johnston Jr. E.R., "Vector Mechanics for Engineers (In SI Units): Statics and Dynamics", 8th Edition, Tata McGraw-Hill Publishing company, New Delhi (2004).
2. Popov, E.P, "Engineering Mechanics of Solids", Prentice-Hall of India, New Delhi, (2009).
3. Kazmi, S. M. A., Solid Mechanics, TMH, Delhi, India., 2008.
4. Rajasekaran S and Sankarasubramanian G., "Engineering Mechanics Statics and Dynamics", 3rd Edition, Vikas Publishing House Pvt. Ltd., 2005.

REFERENCES:

1. Bhavikatti, S.S and Rajashekarappa, K.G., "Engineering Mechanics", New Age International (P) Limited Publishers, 2009.
2. Hibbeller, R.C and Ashok Gupta, "Engineering Mechanics: Statics and Dynamics", 11th Edition, Pearson Education 2010.
3. Irving H. Shames and Krishna Mohana Rao. G., "Engineering Mechanics – Statics and Dynamics", 4th Edition, Pearson Education 2006.

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191EIC201T	ELECTRIC CIRCUIT ANALYSIS	L	T	P	R	C
		2	2	0	0	3

OBJECTIVES:

1. To input fundamental concepts on electric circuits
2. To apply network theorems in DC and AC circuits.
3. To impart knowledge on sinusoidal steady state analysis of RLC circuits.
4. To introduce the phenomenon of resonance in coupled circuits.
5. To educate on obtaining the transient response of circuits.

UNIT I FUNDAMENTAL CONCEPTS **9 Hours**

Circuit elements, Series and parallel combination of Circuit elements - Energy Sources - Source Transformation- Star-Delta connection - Kirchhoff's laws - Current division - Voltage division - Nodal and mesh analysis in DC and AC electric circuits.

UNIT II APPLICATION OF NETWORK THEOREMS IN DC & AC CIRCUITS **9 Hours**

Application of network theorems in DC & AC circuits: Thevenins and Norton Theorems – Superposition Theorem – Maximum power transfer theorem – Reciprocity Theorem – Millman's theorem.

UNIT III SINUSOIDAL STEADY STATE ANALYSIS OF RLC CIRCUITS **9 Hours**

Sinusoidal steady state analysis of RLC circuits with phasor diagram: Series and parallel AC circuits- Series and Parallel Combinations of RL, RC and RLC Circuits.

UNIT IV RESONANCE AND COUPLED CIRCUITS **9 Hours**

Series and parallel resonance – Frequency response – Quality factor and Bandwidth – Coupled Circuits - Self and mutual inductance – Dot Conversion - Coefficient of coupling – Tuned circuits – Single tuned circuits.

UNIT V TRANSIENT RESPONSE ANALYSIS **9 Hours**

L and C elements - Transient response of RL, RC and RLC Circuits using Laplace transform for DC input and A.C. sinusoidal input.

Total: 45 HOURS

COURSE OUTCOMES:

Students will be able to

1. Understand and apply fundamental concepts on electric circuits analyze electrical circuits
2. Apply network theorems in DC and AC circuits.
3. Gain knowledge on sinusoidal steady state analysis of RLC circuits and apply.
4. Understand the phenomenon of resonance in coupled circuits.
5. Get the transient response of circuits DC input and A.C. sinusoidal input.

TEXT BOOKS:

1. Abhijit Chakrabarti, "Circuits Theory - Analysis and synthesis, , 7th Edition, Dhanpath Rai & Sons, New Delhi, 2015.
2. Hayt.W.H., Kemmerly.J.E., Durbin.S.M., "Engineering Circuit Analysis", 7th Edition, Tata McGraw Hill, New Delhi, 2010.
3. Sudhakar. A and Shyammohan S Palli, "Circuits and Network Analysis and Synthesis", 3rd Edition, Tata McGraw Hill, New Delhi, 2015.

REFERENCES:

1. Charles K. Alexander, Mathew N.O. Sadiku, “Fundamentals of Electric Circuits”, Second Edition, McGraw Hill
2. Jegatheesan, R., “Analysis of Electric Circuits”, McGraw Hill, 2015.
3. Joseph A. Edminister, MahmoodNahri, “Electric circuits”, Schaum’s series, McGraw- Hill, New Delhi, 2010.
4. Mahadevan.K., Chitra, C., “Electric Circuits Analysis,” Prentice-Hall of India Pvt Ltd., New Delhi, 2015.
5. Richard C. Dorf and James A. Svoboda, “Introduction to Electric Circuits”, 7th Edition, John Wiley & Sons, Inc. 2015.

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191CYM201T	ENVIRONMENTAL SCIENCE	L	T	P	R	C
		3	0	0	0	3

OBJECTIVES:

- To appreciate and acquire knowledge about nature, environmental education and biodiversity.
- To understand the interrelationship between living organism and environment, environment functions and its value.
- To assess the environmental pollution and its impact on the human world.
- To find and implement scientific, economic and political solutions to environmental problems.
- To gain knowledge about waste management and resource recovery for protecting the environment.

UNIT I - ENVIRONMENT AND BIODIVERSITY **9 Hours**

Definition and scope of an environment – structure of an ecosystem -biotic and abiotic components- ecological succession – food chain, food web – Introduction to biodiversity definition, types – biogeographical classification of India, India as a mega-diversity nation – values of biodiversity- endangered and endemic species of India hot-spots of biodiversity – threats to biodiversity – conservation of biodiversity

UNIT II – NATURAL RESOURCES AND ITS CONSERVATION **9 Hours**

Forest resources - Uses and over exploitation, Deforestation, causes and its effects - Water Resources – Uses and over utilization - Water conservation- Dams, benefits and their effects, Rain Water Harvesting, Watershed Management – Mineral resources - Uses and exploitation, Food resources- World food problems - Effects of modern agriculture – Energy resources - Ocean energy, Geothermal energy, Biomass energy

UNIT III - ENVIRONMENTAL DEGRADATION **9 Hours**

Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Noise pollution (e) Thermal pollution – role of an individual in prevention of pollution – pollution case studies – disaster management: cyclone, flood, drought, earthquake and landslides - case studies

UNIT IV –SOCIAL ISSUES **9 Hours**

Population and Sustainability: Population explosion - Sustainable development – Equitable use of resources for sustainable lifestyles-urban problems related to energy - Role of information technology in environment and human health.

Industrial effluent treatment: Removal of organic constituents-Biological oxidation process-Removal of inorganic constituents-Metal and radioactive wastes, zero liquid discharge solutions from textile industries.

UNIT V – WASTE MANAGEMENT AND RESOURCE RECOVERY **9 Hours**

Introduction -Biodegradable, non-biodegradable waste, Municipal solid waste and its management - Special waste – E-waste and Scrap tires - Definition, causes, effects and its management - Resource recovery: a) Waste land reclamation b) Sewage treatment c) Recycling of Plastic, Glass and Paper wastes.

Total : 45 HOURS

COURSE OUTCOMES:

1. Environmental education initiates an awareness, deeper understanding and sensitivity to the environment and environmental challenges.
2. Acquired knowledge about the principles of nature, environment and their protection
3. Created an involvement to the public to implement environmental laws effectively.
4. Environmental education allows an individual to explore and think about the modern lifestyle has lead to serious environmental disasters and should develop the skills to make responsible decisions.
5. Acquired skills to behave ecofriendly.

TEXT BOOKS:

1. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2006.
2. Handbook of Solid Waste Management (McGraw-Hill Handbooks), George Tchobanoglous, Frank Kreith, Publisher: McGraw-Hill Education; 2 edition July, 2002

REFERENCE BOOKS:

1. R.K. Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media.
2. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT LTD,New Delhi, 2007.
3. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press 2005.
4. *Waste Management and Resource Recovery,* Charles R. Rhyner, Leander J.Schwartz, Robert B. Wenger, Mary G. Kohrell, CRC Press Published August 31, 1995.
5. Industrial wastewater management, treatment and disposal, Water management" Federation Alexandria Virgiia, Third Edition, 2008.

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191GES211L	ENGINEERING PRACTICES LABORATORY	L	T	P	R	C
		0	0	4	0	2

OBJECTIVES:

To provide exposure to the students with the concepts involved in product realization by carrying out manufacturing shop exercises. Hands-on practice with manufacturing shop exercises and assembly leading to realization of a new product in a group.

GROUP A (CIVIL & MECHANICAL)

CIVIL & MECHANICAL ENGINEERING PRACTICE **30 HOURS**

I CIVIL ENGINEERING PRACTICE

A. Plumbing Works:

1. Pipeline joints, its location and functions: Valves, Taps, Couplings, Unions, Reducers, Elbows in household fittings.
2. Connection of two Galvanized Iron pipes
3. Connection of PVC pipes
4. Basic pipe connections involving the fitting like Valves, Taps and Bends

B. Carpentry works:

1. Joints in Roofs, Doors, Windows and Furniture.
2. Cross Lap joint
3. Mortise and Tenant joint

II MECHANICAL ENGINEERING PRACTICE

A. Welding:

1. Arc welding of Butt joints, Tap joints and Tee joints.
2. Gas welding practice

B. Basic machining:

1. Simple Turning and Taper turning
2. Drilling practice

C. Sheet metal work:

1. Rectangular tray making
2. Funnel making

GROUP B (ELECTRICAL & ELECTRONICS)

III ELECTRICAL ENGINEERING PRACTICE **30 HOURS**

1. Residential house wiring using switches, fuse, indicator, lamp and energy meter.
2. Fluorescent lamp wiring.
3. Stair case wiring
4. Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit.
5. Measurement of energy using single phase energy meter.
6. Measurement of resistance to earth of electrical equipment.
7.

IV ELECTRONICS ENGINEERING PRACTICE

1. Electronic components and equipments – Resistor, colour coding measurement of AC signal parameter (peak-peak, RMS period, frequency) using CR.
2. Logic gates AND, OR, EX-OR and NOT.
3. Generation of Clock Signal.
4. Soldering practice – Components Devices and Circuits – Using general purpose PCB.
5. Measurement of ripple factor of HWR and FWR.

COURSE OUTCOMES:

On successful completion of this course, the student will be able to

1. Fabricate carpentry components and pipe connections including plumbing works.
2. Use welding equipments to join the structures.
3. Carry out the basic machining operations
4. Make the models using sheet metal works
5. Carry out basic home electrical works and Understand works of Home Appliances
6. Measure the electrical quantities
7. Elaborate on the Electronic components, Logic gates and soldering practice.

Total: 60 Hours

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191GES212L BASIC ELECTRICAL AND ELECTRONICS ENGINEERING LABORATORY

L	T	P	R	C
0	0	4	0	2

(Common to Automobile, Biomedical, Mechanical and R&A Engineering)

OBJECTIVES:

To train the students in performing various tests on Electrical machines, Sensors and circuits.

LIST OF EXPERIMENTS:

1. Load test on separately excited DC generator
2. Load test on Single phase Transformer
3. Load test on Induction motor
4. Verification of Circuit Laws
5. Load test on DC shunt motor.
6. Diode based application circuits
7. Transistor based application circuits
8. Study of CRO and measurement of AC signals
9. Characteristics of LVDT
10. Calibration of Rotometer
11. RTD and Thermistor

COURSE OUTCOMES:

Ability to understand and apply circuit theorems, basic concepts in Electrical and Electronics Engineering applications.

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SYLLABUS FOR THIRD SEMESTER SUBJECTS

191MAB301T	TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS	L	T	P	R	C
		3	2	0	0	4

PREREQUISITES: NIL

COURSE OBJECTIVES:

1. To introduce the basic concepts of PDE for solving standard partial differential equations.
2. To introduce Fourier series analysis that is central to many applications in engineering apart from its use in solving boundary value problems.
3. To acquaint the student with Fourier series techniques in solving heat flow problems used in various situations.
4. To acquaint the student with Fourier transform techniques used in wide variety of situations
5. To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes and to develop Z transform techniques for discrete time systems.

UNIT I PARTIAL DIFFERENTIAL EQUATIONS **12 Hours**

Formation of partial differential equations - Singular integrals - Solutions of standard types of first order partial differential equations - Lagrange's linear equation - Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and non-homogeneous types.(Exponential sin(ax+by) and cos (ax+by))

UNIT II FOURIER SERIES **12 Hours**

Dirichlet's conditions - General Fourier series - Odd and even functions – Half range sine series - Half range cosine series - Complex form of Fourier series -Parseval's identity - Harmonic analysis.

UNIT III APPLICATIONS OF PARTIALDIFFERENTIAL EQUATIONS **12 Hours**

Classification of PDE -Method of separation of variables - Fourier Series Solutions of one dimensional wave equation - One dimensional equation of heat conduction - Steady state solution of two dimensional equation of heat conduction.

UNIT IV FOURIER TRANSFORMS **12 Hours**

Statement of Fourier integral theorem - Fourier transform pair - Fourier sine and cosine transforms - Properties - Transforms of simple functions – Convolution theorem - Parseval's identity

UNIT V TRANSFORMS AND DIFFERENCE EQUATIONS **12 Hours**

Z-transforms - Elementary properties - Inverse Z-transform (using partial fraction and residues) - Initial and final value theorems - Convolution theorem – Formation of difference equations - Solution of difference equations using Z - transform.

TOTAL PERIODS: 60 Hours

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

- **CO1:** Understand how to solve the given standard partial differential equations.
- **CO2:** Solve differential equations using Fourier series analysis which plays a vital role in engineering applications.
- **CO3:** Appreciate the physical significance of Fourier series techniques in solving one- and two-dimensional heat flow problems and one-dimensional wave equations
- **CO4:** Understand the mathematical principles on transforms and partial differential equations would provide them the ability to formulate and solve some of the physical problems of engineering
- **CO5:** Use the effective mathematical tools for the solutions of partial differential equations by using Z transform techniques for discrete time systems.

TEXT BOOKS:

1. Grewal B.S., "Higher Engineering Mathematics", 43rd Edition, Khanna Publishers, New Delhi, 2014.
2. Narayanan S., Manicavachagom Pillay T.K and Ramanaiah G "Advanced Mathematics for Engineering Students", Vol. II & III, S.Viswanathan Publishers Pvt. Ltd, Chennai, 1998.

REFERENCE BOOKS:

1. Andrews L.C and Shivamoggi, B, "Integral Transforms for Engineers" SPIE Press, 1999.
2. BaliN.P. and Manish Goyal, *"A* Textbook of Engineering Mathematics", 9th Edition, Laxmi Publications Pvt. Ltd, 2014.
3. Erwin Kreyszig, "Advanced Engineering Mathematics ", 10th Edition, John Wiley, India, 2016.
4. James. G, "Advanced Modern Engineering Mathematics", 3rd Edition, Pearson Education, 2007.
5. Ramana. B. V., "Higher Engineering Mathematics", McGraw Hill Education Pvt. Ltd, New Delhi, 2016.
6. Wylie R.C. and Barrett L.C., "Advanced Engineering Mathematics "Tata McGraw Hill Education Pvt. Ltd, 6th Edition, New Delhi, 2012.

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191EIS301T	ELECTRONIC DEVICES AND CIRCUITS	L	T	P	R	C
		3	0	0	0	3

PREREQUISITES: NIL

COURSE OBJECTIVES:

1. To understand the operation of various semiconductor devices.
2. To illustrate the characteristics of Bipolar Junction Transistor.
3. To illustrate the characteristics of JFET and MOSFET.
4. To familiarize the operation of Feedback Amplifiers and Oscillators.
5. To expose the concepts of Large signal, Differential and Tuned Amplifiers.

UNIT I SEMICONDUCTOR DEVICES 9 Hours

Qualitative theory of the p-n Junction - Construction and V-I Characteristics: P-N Junction Diode, Zener Diode, SCR, DIAC, TRIAC Applications of Diode: Half-Wave Rectifier, Full-Wave Rectifier, Bridge Rectifier, Clipping Circuits, Clamper Circuits, Voltage Regulation using Zener Diode - Structure, Operation and characteristics of UJT.

UNITII BIPOLAR JUNCTION TRANSISTOR 9 Hours

Construction, Input and Output Characteristics of CB, CE, CC Configuration- Transistor Biasing: Operating Point, Bias Stability, Collector-to-Base Bias, Emitter-Feedback bias, Collector-Emitter Feedback bias, Voltage-Divider Bias- Transistor Hybrid Model- Determination of h-parameters of CE configuration.

UNIT III FIELD-EFFECT TRANSISTORS 9 Hours

Structure, Operation, Drain and Transfer Characteristics of JFET, MOSFET-FET Small-Signal Model- Small signal analysis of Common -Source Amplifier, Common – Drain Amplifier-Biasing a FET with fixed Bias, Self-Bias ,Biasing a MOSFET with fixed bias, Drain-to-gate bias, Self-bias .

UNIT IV FEEDBACK AMPLIFIERS AND OSCILLATORS 9 Hours

Classification of Amplifiers- Feedback Concept- Characteristics of Negative Feedback Amplifiers-Effect of Feedback upon Input and Output Resistance- Theory of Sinusoidal Oscillators- Phase Shift Oscillator, Wein bridge Oscillator- Theory of Resonant circuit Oscillators: Colpitts Oscillator, Hartley Oscillator, Crystal Oscillator.

UNIT V LARGE SIGNAL AMPLIFIERS, DIFFERENTIAL AND TUNED AMPLIFIERS **9 Hours**

Large Signal Amplifiers: Class A Amplifier, Class B Amplifier, Class AB Operation-Differential amplifiers: Common mode analysis, differential mode analysis, DC analysis, AC analysis-Tuned amplifiers: Characteristics, Single tuned amplifiers, double tuned amplifiers.

TOTAL PERIODS: 45 Hours

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

CO1: Outline the construction and characteristics of semiconductor devices

CO2: Design biasing and modeling circuits for amplifier using BJT

CO3: Design biasing and modeling circuits for amplifier using FET

CO4: Implement design procedure for feedback circuit and various types of oscillator circuits.

CO5: Design the differential amplifier circuits and tuned amplifier circuits using BJT and FET.

TEXT BOOKS:

1. Jacob Millman, Christos C. Halkias and Sathyabrata Jit, Electronic Devices and Circuits, 4th edition, Tata McGraw Hill, New Delhi, 2017
2. Robert L. Boylestad & Louis Nashelsky, Electronic Devices & Circuit Theory, 11th edition, Pearson Education,2015
3. Thomas L.Floyd, “Electronic devices” Conventional current version, Pearson prentice hall, 10th Edition,2017.

REFERENCE BOOKS:

1. Balbir Kumar, Shail.B.Jain, “Electronic devices and circuits” PHI learning private limited, 2nd edition2014.
2. David A. Bell,”Electronic devices and circuits”, Oxford University higher education, 5th edition2008.
3. Donald A. Neaman, “Electronic Circuits Analysis and Design”, 3rd edition, Tata McGraw Hill, 2008.

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191BMC301T SENSORS AND MEASUREMENTS

L	T	P	R	C
3	0	0	0	3

PREREQUISITES: NIL

COURSE OBJECTIVES:

1. To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues.
2. To understand the purpose of measurement, the methods of measurements, errors associated with measurements.
3. To know the principle of transduction, classifications and the characteristics of different transducers and study its biomedical applications.
4. To illustrated the bridges, filters and amplifiers
5. To evaluate the different display and recording devices.

UNIT I SCIENCE OF MEASUREMENT **9 Hours**

Measurement System – Instrumentation – Classification and Characteristics of Transducers – Static and Dynamic – Errors in Measurements – Calibration – Primary and secondary standards.

UNIT II DISPLACEMENT, PRESSURE, TEMPERATURE SENSORS **9 Hours**

Resistive Transducers: Strain Gauge: Gauge factor, sensing elements, configuration, biomedical applications; strain gauge as displacement & pressure transducers, RTD materials & range, Characteristics, thermistor characteristics, biomedical applications of Temperature sensors Capacitive transducer, Inductive transducer, LVDT, Active type: Thermocouple –characteristics.

UNIT III PHOTOELECTRIC AND PIEZOELECTRIC SENSORS **9 Hours**

Phototube, scintillation counter, Photo Multiplier Tube (PMT), photovoltaic, Photo conductive cells, photo diodes, phototransistor, comparison of photoelectric transducers, spectrophotometric applications of photo electric transducers. Piezoelectric active transducer and biomedical applications as pressure & Ultrasound transducer.

UNIT IV SIGNAL CONDITIONING &SIGNAL ANALYSER **9 Hours**

AC and DC Bridges – Wheat stone bridge, Kelvin, Maxwell, Hay, Schering – Concepts of filters, Pre-amplifier – impedance matching circuits – isolation amplifier. Spectrum analyzer.

UNIT V DISPLAY AND RECORDING DEVICES **9 Hours**

Digital voltmeter – Multi meter – CRO – block diagram, CRT – vertical & horizontal deflection system, DSO, LCD monitor, PMMC writing systems, servo recorders, photographic recorder, magnetic tape recorder, Inkjet recorder, thermal recorder. Demonstration of the display and recording devices.

TOTAL PERIODS: 45 HOURS

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

CO1: Describe the purpose and methods of measurements.

CO2: Explain the principle of different sensors and its applications.

CO3: Analyze the characteristics of different transducers.

CO4: Describe the need and function of various signal conditioning circuits.

CO5: Explain different display and recording devices for various applications.

TEXT BOOKS:

1. Albert D. Helfrick and William D. Cooper, “Modern Electronic Instrumentation and Measurement Techniques”, Prentice Hall of India, 2007.
2. Doebelin E.O. and Manik D.N., “Measurement Systems”, Tata McGraw-Hill Education Pvt. Ltd., 6th Edition, 2011.
3. L.A Geddes and L. E. Baker, “Principles of Applied Biomedical Instrumentation”, – John Wiley and sons, 3rd Edition, Reprint 2008.

REFERENCE BOOKS:

1. Khandpur R.S, “Handbook of Biomedical Instrumentation”, Tata McGraw Hill, New Delhi, 3rd Edition, 2014.
2.. Leslie Cromwell, Fred J. Weibell, Erich A. Pfeiffer, “Biomedical Instrumentation and Measurement”, Prentice Hall India Pvt. Ltd, New Delhi, 2nd Edition, Reprint, 2013.
3. Sawhney A.K., “Electrical & Electronics Measurement and Instrumentation”, Dhanpat Rai & Co, New Delhi, 17th Edition, 2004.

E-BOOKS / WEB REFERENCES:

1. Sensors and Signal Processing
   https://nptel.ac.in/content/storage2/courses/112103174/pdf/mod2.pdf

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191BMH301T	HOSPITAL MANAGEMENT	L	T	P	R	C
		3	0	0	0	3

PREREQUISITES: NIL

COURSE OBJECTIVES:

1. To study the basic concepts of hospital management and biomedical waste disposal concept
2. To understand the principles, practices of HRM and HRD
3. To be familiar with marketing research and consumer behaviour
4. To know the concepts of hospital information systems and supportive services
5. To learn the quality and safety aspects in hospital

UNIT I OVERVIEW OF HOSPITAL ADMINISTRATION **7 Hours**

Distinction between Hospital and Industry, Challenges in Hospital Administration –Hospital Planning – Equipment Planning- AMC – Functional Planning - Current Issues in Hospital Management - Telemedicine - Bio-Medical Waste Management.

UNIT II HUMAN RESOURCE MANAGEMENT INHOSPITAL **9 Hours**

Principles of HRM – Functions of HRM – Profile of HRD Manager – Tools of HRD –Human Resource Inventory – Manpower Planning. Different Departments of Hospital, Recruitment, Selection, Training Guidelines –Methods of Training – Evaluation of Training – Leadership grooming and Training, Promotion – Transfer.

UNIT III MARKETING RESEARCH & CONSUMER BEHAVIOUR **10 Hours**

Marketing information systems - assessing information needs, developing & disseminating information - Market Research process - Other market research considerations - Consumer Markets & Consumer Buyer behavior - Model of consumer behavior - Types of buying decision behavior - The buyer decision process - Model of business buyer behavior - Major types of buying situations - global marketing in the medical sector - WTO and its implications.

UNIT IV HOSPITAL INFORMATION SYSTEMS & SUPPORTIVE SERVICES **10 Hours**

Management Decisions and Related Information Requirement - Clinical Information Systems - Administrative Information Systems - Support Service Technical Information Systems – Medical Transcription, Medical Records Department – Central Sterilization and Supply Department – Pharmacy- Food Services - Laundry Services.

UNIT V QUALITY AND SAFETY ASPECTS IN HOSPITAL **9 Hours**

Quality system – Elements, implementation of quality system, Documentation, Quality auditing, International Standards ISO 9000 – 9004 – Features of ISO 9001 – ISO 14000 – ISO 13485, Environment Management Systems. NABA, JCI, NABL, NABH. Security – Loss Prevention – Fire Safety – Alarm System – Safety Rules. Health Insurance & Managing Health Care – Medical Audit Hazard and Safety in a hospital Setup.

TOTAL PERIODS: 45 Hours

COURSE OUTCOMES:

Upon completion of this course, student will be able to

- **CO1:** Understand the basic concepts of hospital management and biomedical waste disposal concept
- **CO2:** Illustrate the principles, practices of HRM and HRD
- **CO3:** Describe the marketing research and consumer behavior
- **CO4:** Explain the importance of supportive services
- **CO5:** Comprehend the quality aspect specified by the international standards

TEXT BOOKS:

1. Goyal. R.C., "Hospital Administration and Human Resource Management", PHI-4th Edition, 2006.
2. Kunders G.D., "Hospitals – Facilities Planning and Management", TMH, New Delhi – 5thedition Reprint 2007.

REFERENCE BOOKS:

1. Arnold D. Kalcizony & Stephen M.Shortell, "Health Care Management", 6th Edition, 2011.
2. Blane, David, Brunner, Eric, "Health and Social organization: Towards a health policy for the 21st century", Calrendon Press,1994.
3. Cesar A.Caceres and Albert Zara, "The Practice of Clinical Engineering", Academic Press, NewYork, 1977.
4. Norman Metzger, "Handbook of Health Care Human Resources Management", Aspen Publication Inc. Rockville, Maryland, USA, 2nd Edition1990.
5. Peter Berman, "Health Sector Reform in Developing Countries", Harvard University Press,1995
6. William.A.Reinke, "Health Planning For Effective Management", Oxford University Press, 1988.

E-BOOKS / WEB REFERENCES:

1. https://www.kopykitab.com/Hospital-Administration-And-Human-Resource-Management-by-D-K-Sharma-and-R-C-Goyal
2. https://books.google.co.in/books/about/Hospitals.html?id=SE8p0Xrn3kwC
3. https://usakochan.net/download/shortell-and-kaluzny-s-healthcare-management-organization-design-and-behavior/
4. https://www.bmj.com/content/312/7047/1680.2

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		L	T	P	R	C
191BMB301T	ANATOMY AND PHYSIOLOGY	3	0	0	0	3

PREREQUISITES: NIL

COURSE OBJECTIVES:

1. To know basic structural and functional elements of human body.
2. To learn the functions of respiratory system and urinary system
3. To understand the concept of blood and cardiovascular system
4. To be familiar with the skeletal and special sensory system
5. To study the basics of nervous system

UNIT I BASIC ELEMENTS OF HUMAN BODY 9 Hours

Cell: Structure and organelles - Functions of each component in the cell. Cell membrane – transport across membrane – Origin of cell membrane potential – Action potential. Homeostasis Tissue: Types – Specialized tissues – functions.

UNIT II RESPIRATORY SYSTEM AND URINARY SYSTEM 9 Hours

Respiratory System: Components of respiratory system – Respiratory Mechanism. Types of respiration - Oxygen and carbon dioxide transport and acid base regulation. Urinary system: Structure of Kidney and Nephron. Mechanism of Urine formation – Urinary reflex – Homeostasis and blood pressure regulation by urinary system.

UNIT III BLOOD AND CARDIOVASCULAR SYSTEM 9 Hours

Blood composition - functions of blood – functions of RBC.WBC types and their functions Blood groups – importance of blood groups – identification of blood groups. Blood vessels - Structure of heart – Properties of Cardiac muscle – Conducting system of heart – Cardiac cycle – Heart sound- Volume and pressure changes and regulation of heart rate – Coronary Circulation. Factors regulating Blood flow.

UNIT IV SKELETAL AND SPECIAL SENSORY SYSTEM 9 Hours

Skeletal system: Bone types and functions – Axial Skeleton and Appendicular Skeleton. Joint-Types of Joint – Cartilage structure, types and functions. Special Sensory system- Eye and Ear

UNIT V NERVOUS SYSTEM 9 Hours

Structure of a Neuron – Types of Neuron. Neuroglia Cells - Synapses and types. Brain – Divisions of brain lobes – Cross Sectional Anatomy of Brain - Cortical localizations and functions. Spinal cord – Tracts of spinal cord – Spinal Nerve - Reflex mechanism – Types of reflex. Autonomic nervous system and its functions.

TOTAL PERIODS: 45 Hours

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

CO1: Describe basic structural and functional elements of human body.

CO2: Explain gaseous exchange and fluid maintenance in the human body.

CO3: Enlighten organs and structures involving in circulatory system.

CO4: Identify the various types of bones and sense organs

CO5: Elucidate the functioning of central nervous system.

TEXT BOOKS:

1. Elaine. N. Marieb, “Essential of Human Anatomy and Physiology”, Pearson Education New Delhi, 8th Edition, 2007.
2. Gillian Pocock, Christopher D. Richards, "The Human Body An introduction for Biomedical and Health Sciences", Oxford University Press, USA, 2009.

REFERENCE BOOKS:

1. Arthur C. Guyton, "Text book of Medical Physiology", Elsevier Saunders, 11th Edition, 2006.
2. Eldra Pearl Solomon. "Introduction to Human Anatomy and Physiology", W.B.Saunders Company, 2003.
3. William F. Ganong, "Review of Medical Physiology”, Mc Graw Hill, New Delhi, 25th Edition, 2015.

E-BOOKS / WEB REFERENCES:

1. Animal Physiology : https://nptel.ac.in/courses/102/104/102104058/

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191BMS311L	DEVICES AND CIRCUITS LABORATORY	L	T	P	R	C
		0	0	3	1	2

COURSE OBJECTIVES:

1. To exposed the RL and RC circuits.
2. To be familiar with Thevenin, KVL & KCL, and Super Position Theorems.
3. To know series and parallel resonance circuits
4. To learn the characteristics of basic electronic devices.
5. To understand the characteristics of Amplifiers.

LIST OF EXPERIMENTS

1. Verification of ohm‘s law, Kirchhoff‘s law, and Thevenin‘s theorem
2. Verification of superposition theorem and Maximum power transfer theorem
3. Frequency response of series resonance and parallel resonance circuits
4. Transient analysis of RL and RC circuits.
5. PN Junction Diode Characteristics and application as half wave and full wave rectifiers.
6. Zener Diode Characteristics and application as voltage regulator.
7. FET Characteristics.
8. Characteristics of Thyristor and UJT.
9. Frequency Response of CE Amplifier.
10. Design and Analysis of Feedback Amplifiers.
11. Design and Analysis of Differential Amplifier.
12. Design of RC Oscillators and LC Oscillators using BJT.
13. General PCB design and practice for simple circuits.
14. Design and analysis of simple circuits using simulation tools.

TOTAL PERIODS: 60 Hours

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

CO1: Design RL and RC circuits.

CO2: Verify Thevenin & Norton theorem KVL & KCL, and Super Position Theorems.

CO3: Draw the characteristics of series and parallel resonance circuits.

CO4: Discuss the characteristics of basic electronic devices.

CO5: Perform the characteristics of Amplifiers.

REFERENCES:

1. Basic Electronics NPTEL link: https://nptel.ac.in/courses/117/103/117103063/
2. Semiconductor devices and circuits NPTEL LINK: https://nptel.ac.in/courses/108/108/108108112/

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191BMC312L	SENSORS AND MEASUREMENTS LABORATORY	L	T	P	R	C
		0	0	3	1	2

COURSE OBJECTIVES:

1. To learn the characteristics of displacement transducers
2. To measure the temperature using various transduces
3. To evaluate the resistance, inductance and capacitance using bridges
4. To understand the characteristics of passive filters
5. To study the signal conditioning circuits and display devices.

LIST OF EXPERIMENTS

1. Characteristics of strain gauges.
2. Displacement measurement using LVDT.
3. Characteristics of temperature sensor-thermistor.
4. Characteristics of temperature sensor-RTD.
5. Characteristics of thermocouple.
6. Characteristics of Light sensors-LDR, Photo Diode, Photo Transistor.
7. Characteristics of Piezoelectric Transducer.
8. Wheatstone Bridge and Kelvin's Bridge for Measurement of Resistance.
9. Measurement of capacitance using bridge circuits.
10. Measurement of inductance using bridge circuits.
11. Characteristics of passive filters.
12. Force measurement using force sensor and calibration.
13. Study of Multimeter and Medical Oscilloscope.
14. Study of Input / Output characteristics using X – Y oscilloscope.

TOTAL PERIODS: 60 Hours

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

- **CO1:** Construct a measurement system for various applications
- **CO2:** Develop a system for temperature measurements
- **CO3:** Design and develop bridge circuits to find unknown variables.
- **CO4:** Evaluate and analyze filter characteristics.
- **CO5:** Demonstrate the Input / Output characteristics using X – Y oscilloscope

REFERENCES:

1. Sensors and transducers:https://nptel.ac.in/content/storage2/courses/112103174/pdf/mod2.pdf

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SYLLABUS FOR FOURTH SEMESTER SUBJECTS

191BMC401T	FUNDAMENTALS OF BIOCHEMISTRY	L	T	P	R	C
		3	0	0	0	3

PREREQUISITES: NIL

COURSE OBJECTIVES:

1. To study the basic concepts of biochemistry
2. To get a clear idea of carbohydrates and its cycle
3. To know the significance of lipids and saponification process
4. To understand the metabolic pathways in normal and pathological conditions.
5. To be familiar with the types of enzymes

UNIT I INTRODUCTION TO BIOCHEMISTRY **9 Hours**

Introduction to Biochemistry, water as a biological solvent, weak acid and bases, pH, buffers, Handerson - Hassel Balch equation, physiological buffers, fitness of the aqueous environment for living organism. Principle of viscosity, surface tension, adsorption, diffusion, osmosis and their applications in biological systems.

UNIT II CARBOHYDRATES **9 Hours**

Classification of carbohydrates mono, di, oligo and polysaccharides. Isomerism, racemization and mutarotation. Structure, physical and chemical properties of carbohydrates. Metabolic pathways and bioenergetics – Glycolysis, glycogenesis, glycogenolysis and its hormonal regulation. TCA cycle and electron transport chain. Oxidative phosphorylation.

UNIT III LIPIDS **9 Hours**

Classification of lipids- simple, compound and derived lipids. Nomenclature of fatty acid, physical and chemical properties of fat. Saponification number, Reichert- Meissl number and iodine number. Metabolic pathways: synthesis and degradation of fatty acid (beta oxidation), hormonal regulation of fatty acid metabolism, ketogenesis, structural architecture and significance of biological membrane.

UNIT IV NUCLEIC ACID & PROTEIN **9 Hours**

Structure of purines and pyrimidines, nucleoside, nucleotide, DNA act as a genetic material, chargaffs rule. Watson and crick model of DNA. Structure of RNA and its type. Classification, structure and properties of proteins, structural organization of proteins, classification and properties of amino acids. Separation of protein: gel filtration, electrophoresis and ultracentrifugation.

UNIT V ENZYME AND ITS KINETICS **9 Hours**

Classification of enzymes, apoenzyme, coenzyme, holoenzyme and cofactors. Kinetics of enzymes - Michaelis - Menten equation. Factors affecting enzymatic activity: temperature, pH, substrate concentration and enzyme concentration. Inhibitors of enzyme action: Competitive, non- competitive, irreversible. Enzyme: Mode of action, allosteric and covalent regulation. Clinical significance of enzymes. Measurement of enzyme activity and interpretation of units.

TOTAL PERIODS: 45 Hours

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

- **CO1:** Describe the surface properties involved in biological systems
- **CO2:** Explain about Carbohydrates and its cycles
- **CO3:** Enlighten the functions of Lipids and saponification process
- **CO4:** Assess the significance of Nucleic Acid and Protein
- **CO5:** Analyze the significance of biological enzymes

TEXT BOOKS:

1. David L. Nelson, Michael M.Cox, Lehninger "Principles of Biochemistry Macmillan", 6th Edition 2013.
2. Keith Wilson and John Walker, "Practical Biochemistry- Principles &Techniques", Oxford University press, 7th Edition, 2010.

REFERENCE BOOKS:

1. Pamela. C. Champe and Richard. A. Harvey, "Biochemistry Lippincott's Illustrated Reviews. Lippincott" Raven publishers, 6th Edition, 2013.
2. Trevorpalmer, "Understanding Enzymes", Ellis Horwood LTD, 4th Edition, 1995.

E-BOOKS / WEB REFERENCES:

1. https://www.amazon.in/Lehninger-Principles-Biochemistry-David-Nelson/dp/1464109621
2. https://www.amazon.in/Practical-Biochemistry-Principles-John-Walker/dp/0521799651
3. https://books.google.com/books/about/Biochemistry.html?id=M_YOW50cg9C
4. https://onlinelibrary.wiley.com/doi/abs/10.1002/jctb

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		L	T	P	R	C
191BMC402T	ANALOG AND DIGITAL INTEGRATED CIRCUITS	3	0	0	0	3

PREREQUISITES: NIL

COURSE OBJECTIVES:

1. To study the circuit configuration and introduce practical applications of linear integrated circuits.
2. To introduce the concept of application of ADC and DAC in real time systems and Phase Locked Loop with applications.
3. To know the basic concepts of logic gates.
4. To be familiar with the design of various combinational digital circuits using logic gates.
5. To bring out the analysis and design procedures for synchronous and asynchronous sequential circuits.

UNIT I INTRODUCTION TO OPERATIONAL AMPLIFIER AND ITS APPLICATIONS 9 Hours

Operational amplifier –ideal characteristics, Performance parameters, Linear and Nonlinear Circuits and their analysis-voltage follower, Inverting amplifier, Non inverting Amplifiers, Differentiator, Integrator, Voltage to Current converter, Instrumentation amplifier, Low pass, High pass filter and band pass filters, Comparator, Multi-vibrator and Schmitt trigger, Triangular wave generator.

UNIT II DIGITAL TO ANALOG AND ANALOG TO DIGITAL CONVERTERS AND PLL 9 Hours

Analog switches, High speed sample and hold circuit and IC's, Types of D/A converter -Weighted resistor, R-2R ladder DAC, D/A Accuracy and Resolution. A/D converter - Flash, Dual slope, Successive approximation, A/D Accuracy and Resolution. Voltage controlled oscillator, Voltage to Frequency converters. PLL-Closed loop analysis of PLL, Frequency multiplication/ division, FSK demodulator.

UNIT III THE BASIC GATES AND COMBINATIONAL LOGIC CIRCUITS 9 Hours

Number Systems – Decimal, Binary, Octal, Hexadecimal, 1's and 2's complements, Codes – Binary, BCD, 84-2-1, 2421, Excess 3, Biquinary, Gray, Alphanumeric codes, Boolean theorems, Logic gates, Universal gates, Sum of products and

product of sums, Min terms and Max terms, Karnaugh map and Tabulation methods Logic families- TTL, MOS, CMOS, BiCMOS - Comparison of Logic families.

UNIT IV COMBINATIONAL LOGIC CIRCUITS **9 Hours**

Problem formulation and design of combinational circuits - Code-Converters, Half and Full Adders, Binary Parallel Adder – Carry look ahead Adder, BCD Adder, Magnitude Comparator, Decoder, Encoder, Priority Encoder, Mux/Demux, Implementation of combinational logic using standard ICs, ROM, PLA and PAL.

UNIT V SEQUENTIAL LOGIC CIRCUITS **9 Hours**

Flip flops – SR, JK, T, D, Master/Slave FF, Triggering of FF, Analysis and design of clocked sequential circuits – state minimization, state assignment, circuit implementation. Counters, Ripple Counters, Ring Counters. Types of Registers, Serial In - Serial Out, Serial In - Parallel out, Parallel In -Serial Out, Parallel In - Parallel Out, Universal Shift Register.

TOTAL PERIODS: 45 Hours

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

CO1: Ability to design new analog linear circuits and develop linear IC based Systems.

CO2: Understand the concept of application of ADC and DAC in real time systems and Phase Locked Loop with applications.

CO3: Use Boolean algebra and apply it to digital systems.

CO4: Design various combinational digital circuits using logic gates.

CO5: Bring out the analysis and design procedures for synchronous and asynchronous sequential circuits.

TEXT BOOKS:

1. Charles H.Roth, Jr, “Fundamentals of Logic Design”, Jaico Books, 7th Edition, 2013.
2. Morris Mano.M and Michael D.Ciletti, “Digital Design”, Pearson, 5th Edition,2013.
3. Sergio Franco, “Design with operational amplifiers and analog integrated circuits”, Mc Graw Hill Education, 3rd Edition,2017.

REFERENCE BOOKS:

1. Coughlin and Driscoll, “Operational amplifiers and Linear Integrated Circuits”, Prentice Hall, 6thEdition, 2001.
2. Floyd T.L., “Digital Fundamentals”, Charles E.Merril publishing company, 8th Edition, 2005.
3. Gray and Meyer, “Analysis and Design of Analog Integrated Circuits”, Wiley International, 2009.
4. Michael Jacob J., “Applications and Design with Analog Integrated Circuits”, Prentice Hall of India, 2nd Edition, 2008
5. Ramakant A. Gayakwad, “OP - AMP and Linear IC‘s”, Prentice Hall, 2012.
6. Taub and Schilling, “Digital Integrated Electronics”, Mc Graw Hill, 2017.

E-BOOKS / WEB REFERENCES:

1. https://civildatas.com/digital-design-by-m-morris-mano.
2. https://books.google.co.in/books/about/Fundamentals_of_Logic_Design.html?id=RXGcfwuO_vwC
3. https://easyengineering.net/op-amps-and-linear-integrated-circuit-technology-by-ramakan/
4. https://openlibrary.org/books/OL1741095M/Applications_and_design_with_analog_integrated circuits

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191BMC403T	PHYSIOLOGICAL CONTROL SYSTEMS	L	T	P	R	C
		3	0	0	0	3

PREREQUISITES: NIL

COURSE OBJECTIVES:

1. To study the fundamental mathematical techniques for analysis of given system
2. To know the concepts of transient response analysis
3. To be familiar with the frequency domain analysis
4. To the learn concept of the stability analysis
5. To understand the applications of physiological control system.

UNIT I SYSTEM ANALYSIS- FUNDAMENTAL CONCEPTS 9 Hours

Physiological control systems analysis - differences between engineering and physiological control systems-the science of modeling -generalized system properties models with combinations of system, elements linear models of physiological systems distributed parameter versus lumped parameter models.

UNIT II TRANSIENT RESPONSE ANALYSIS 9 Hours

Linearized respiratory mechanics – open loop and closed loop transient response, first order model, second order model- descriptors of impulse and step responses, open loop versus closed loop dynamics-a model of neuromuscular reflex motion

UNIT III FREQUENCY RESPONSE ANALYSIS 9 Hours

State space responses to sinusoidal inputs, graphical representation of frequency response, frequency response of a model of circulatory control frequency response of glucose – insulin

UNIT IV STABILITY ANALYSIS 9 Hours

Root locus plots - Routh – Hurwitz, stability criterion, Nyquist criterion for stability relative stability, stability analysis of the pupillary light-reflex model of cheyne - stokes breathing.

UNIT V APPLICATIONS IN PHYSIOLOGICAL CONTROL SYSTEM 9 Hours

Basic problems, nonparametric and parametric identification-problems in parameter estimation, identification of closed loop systems, identification under closed loop conditions- optimization, single parameter-optimization constrained optimization, adaptive control.

TOTAL PERIODS: 45 Hours

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

CO1: Develop mathematical model for a given system.

CO2: Determine and analyze the time domain specifications of different systems.

CO3: Determine and Analyze the frequency domain specifications of the different systems

CO4: Perform stability analysis of the given system using various techniques

CO5: Explain the concept and model of physiological control systems.

TEXT BOOKS:

1. Michael C K Khoo, “Physiological control systems”, IEEE Press, Prentice Hall of India, 2005.
2. Nagarath.J and M.Gopal, “Control System Engineering”, New Age International Publishers, 6th Edition, 2008

REFERENCE BOOKS:

1. Constantine H.Houpis, Stuart N. Sheldon, “Linear Control System Analysis and Design with MATLAB”, CRC Press, 6th Edition, 2013.
2. Farid Golnaraghi, Benjamin C. Kuo, “Automatic Control Systems”, Wiley, 9th Edition, 2014.
3. Gopal.M., “Control System, Principles and Design”, McGraw-Hill, 2012.
4. Joseph J. DiStefano, Allen R.Stubberud, Schaum's, ”Outline of Feedback and Control Systems”, McGraw-Hill Education, 2nd Edition,2013.
5. Richard C.Dorf &Robert H. Bishop, “Modern Control Systems”, Prentice Hall, 12th Edition, 2010.

E-BOOKS / WEB REFERENCES:

1. https://www.academia.edu/28183397/Control_Systems_Engineering_I_J_Nagrath_And_ _Gopal_1_
2. https://easyengineering.net/automatic-control-systems-by-kuo/
3. https://books.google.co.in/books/about/Control_Systems.html?id=FZak6CkrVLQC

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191BMC404T	BIOMECHANICS	L	T	P	R	C
		3	0	0	0	3

PREREQUISITES: NIL

COURSE OBJECTIVES:

1. To introduce the mechanics involved with various physiological systems.
2. To gain knowledge in deriving the mathematical models related to blood vessels.
3. To apply concepts into orthopaedic mechanics
4. To understand about mathematical models
5. To be familiar with the orthopaedic applications

UNIT I INTRODUCTION 9 Hours

Scope of mechanics in medicine, mechanics of bone structure, determination of in-vivo elastic modulus. Bio fluid mechanics, flow properties of blood. Anthropometry.

UNIT II MECHANICS OF PHYSIOLOGICAL SYSTEMS 9 Hours

Heart valves, power developed by the heart, prosthetic valves. Constitutive equations for soft tissues, dynamics of fluid flow in cardiovascular system and effect of vibration - shear stresses in extra-corporeal circuits.

UNIT III ORTHOPAEDIC MECHANICS 8 Hours

Mechanical properties of cartilage, diffusion properties of articular cartilage, mechanical properties of bone, kinetics and kinematics of joints, Lubrication of joints.

UNIT IV MATHEMATICAL MODELS 10 Hours

Introduction to Finite Element Analysis, Mathematical models - pulse wave velocities in arteries, determination of in-vivo elasticity of blood vessel, dynamics of fluid filled catheters.

UNIT V ORTHOPAEDIC APPLICATIONS 9 Hours

Dynamics and analysis of human locomotion - Gait analysis (determination of instantaneous joint reaction analysis), occupant response to vehicular vibration. Mechanics of knee joint during standing and walking

TOTAL PERIODS: 45 Hours

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

- **CO1:** Describe the use of mechanics in medicine.
- **CO2:** Understand the mechanics of physiological systems.
- **CO3:** Distinguish the reason for abnormal patterns of orthopeadics
- **CO4:** Analyze the biomechanical systems using mathematical models.
- **CO5:** Design and develop the models specific to orthopedic applications.

TEXT BOOKS:

1. Fung. Y.C. Bio-Mechanics, “Mechanical Properties of Tissues’’,Springer-Verilog,1998.
2. C. Ross Ether and Craig A.Simmons, “Introductory Biomechanics from cells to organisms”, Cambridge University Press, New Delhi, 2009.

REFERENCE BOOKS:

1. B.H.Brown, PV Lawford, RH Small wood, DR Hose, Dc Barber, “Medical Physics and Biomedical Engineering’’, CRC Press, 1999.
2. Dhanjoo N.Ghista, “Orthopaedic Mechanics”, Academic Press, 1990.
3. Haufred Clynes, “Bio-medical Engineering Systems’’, McGrawHill,1998.
4. John Enderle, Susanblanchard, Joseph Bronzino, “Introduction to Biomedical Engineering’’, Elsevier, 2005.
5. Joseph D.Bronzino, “Biomedical Engineering Fundamentals”, Taylor& Francis, 2006.
6. Susan J Hall, “Basics of Biomechanics’’, Mc Graw Hill Publishing.co. New York, 5th Edition, 2007.

E-BOOKS / WEB REFERENCES:

1. https://www.google.co.in/books/edition/Biomechanics/yx3aBwAAQBAJ
2. https://www.google.co.in/books/edition/Introductory_Biomechanics/5-Ml5gJ34RYC
3. https://www.google.co.in/books/edition/Basic_Biomechanics/h39zCgAAQBAJ
4. https://www.google.co.in/books/edition/Orthopaedic_Mechanics/tBifugEACAAJ

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191CSS422T	OBJECT ORIENTED PROGRAMMING USING C++	L	T	P	R	C
		3	0	0	0	3

PREREQUISITES: NIL

COURSE OBJECTIVES:

1. To understand the basic concepts of Object-Oriented Programming concepts
2. To learn about the basic concepts of class and objects.
3. To know the principles of inheritance, pointers and virtual functions
4. To get knowledge about generic programming and exception handling
5. To know about stream classes and files.

UNIT I PRINCIPLES OF OOP **9 Hours**

Programming Paradigms- Basic concepts and benefits of OOP- Structure of C++ program – Applications of C++ - Tokens- Keywords- Identifiers-constants- Data types - Basic, User defined, Derived - Dynamic initialization -Reference variables- Scope resolution operator-Member dereferencing operators- memory management operators- Type casting- Function Prototyping- call by reference, return by reference- Inline function- Default arguments – Function overloading.

UNIT II CLASSES AND OBJECTS **9 Hours**

Class specification- Access qualifiers- Static data members and member functions - Array of objects- Objects as function arguments- Friend functions- Returning objects- Constructors - Destructors - Operator Overloading: Operator function – Overloading unary and binary operator- Overloading the operator using friend function-Type Conversion.

UNIT III INHERITANCE **9 Hours**

Defining Derived classes- Single Inheritance- Multiple Inheritance- Multi level inheritance- Hierarchical Inheritance- Hybrid Inheritance- Multipath inheritance-Virtual Base Class- Abstract class- Constructors in derived and base class- Pointers- pointers to objects – this pointer - Virtual functions-Pure virtual functions.

UNIT IV GENERIC PROGRAMMING WITH TEMPLATES **9 Hours**

Function templates, overloaded function templates, user defined template arguments, class templates - Exception Handling: Exception handling mechanism, multiple catch, nested try, rethrowing the exception – Namespaces – std namespace- Standard Template Library.

UNIT V STREAMS **9 Hours**

Stream classes- Formatted I/O- I/O Manipulators- User defined manipulators- File handling- File pointer and manipulation- Sequential and random access- Error handling.

TOTAL PERIODS: 45 Hours

COURSE OUTCOMES:

Upon completion of this course, student will be able to demonstrate a measurable increase in their knowledge, skills and abilities related to

CO1: Write C++ programs using classes, objects and constructors for various applications

CO2: Design programs for real world examples with code reusability through inheritance

CO3: Implement polymorphism by operator overloading and virtual functions

CO4: Write C++ programs for various applications with file handling, exception handling

CO5: Design programs using generic programming.

TEXT BOOKS:

1. Balagurusamy,. E, “Object Oriented Programming with C++”, Tata McGraw Hill, Sixth Edition, 2013.

REFERENCE BOOKS:

1. Bjarne Stroustrup,"The C++ Programming Language", Pearson Education, FourthEdition, 2013.
2. Easwarakumar K.S, "Object Oriented Data Structures Using C++", Vikas Publication House Pvt Ltd, First Edition, 2000.
3. Robert Lafore, "Object Oriented Programming in Turbo C++", Galgotia Publications,2006.
4. Trivedi B, "Programming with ANSI C++", Oxford University Press, 2007.
5. Venugopal K.R, Rajkumar, T.Ravishankar, "Mastering C++", Tata McGraw Hill,2007.

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191BMC411L	BIOCHEMISTRY LABORATORY	L	T	P	R	C
		0	0	1	1	1

COURSE OBJECTIVES:

1. To provide practice on quantification of biomolecules
2. To understand the estimation of biomolecules in pathological condition
3. To separate the macromolecules

LIST OF EXPERIMENTS

1. General tests for Carbohydrates, proteins and lipids
2. Preparation of serum and plasma from blood
3. Estimation of blood glucose.
4. Estimation of creatinine
5. Estimation of urea
6. Estimation of cholesterol
7. Assay of SGOT/SGPT
8. Separation of proteins by SDS Electrophoresis
9. Separation of amino acids by thin layer chromatography
10. Separation of DNA by agarose gel electrophoresis

TOTAL PERIODS: 30 Hours

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

CO1: Demonstrate the quantification of biomolecules

CO2: Estimate various biomolecules in pathological condition

CO3: Evaluate and Analyse the importance of macromolecules.

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191BMC412L	HUMAN PHYSIOLOGY LABORATORY	L	T	P	R	C
		0	0	1	1	1

COURSE OBJECTIVES:

1. To provide practice on Hematology
2. To understand about the physiology of auditory condition and vision
3. To know the bleeding time and clotting time of blood

LIST OF EXPERIMENTS

1. PCV, MCH, MCV, MCHC, total count of RBCs and hemoglobin estimation.
2. Differential count of different WBCs, RBCs and blood group identification.
3. Ishihara chart for color blindness and Snellen's chart for myopia and hyperopia - by letters reading and ophthalmoscope to view retina
4. Weber and Rinne test for auditory conduction.
5. Calculation of Bleeding Time and Clotting Time of blood

TOTAL PERIODS: 30 Hours

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

CO1: Identify the various blood parameters in pathological conditions.

CO2: Analyze, interpret and report the results of the physiology of auditory condition and vision

CO3: Estimate bleeding time and clotting time of blood

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191BMC413L	ANALOG AND DIGITAL INTEGRATED CIRCUITS LABORATORY	L	T	P	R	C
		0	0	3	1	2

COURSE OBJECTIVES:

1. To design digital logic and circuits
2. To learn the function of different ICs
3. To understand the applications of operational amplifier.
4. To learn the working of multi-vibrators
5. To design circuits for generating waveforms using ICs.

LIST OF EXPERIMENTS

1. Inverting, non-inverting amplifier and comparator
2. Integrator and Differentiator
3. Design and analysis of active filters using operational amplifier
4. Schmitt trigger using operational amplifier
5. Instrumentation amplifier using operational amplifier
6. RC and LC oscillators
7. Multi-vibrators using IC555 Timer
8. Study of logic gates, Half adder and Full-adder
9. Encoder and BCD to 7 segment decoder
10. Multiplexer and demultiplexer using digital ICs
11. Universal shift register using flip-flops
12. Design of mod-N counter
13. Simulation and analysis of circuits using software

TOTAL PERIODS: 60 Hours

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

CO1: Construct Combinational Circuits using logic gates

CO2: Quantify Sequential Circuits using logic gates

CO3: Develop and implement arithmetic circuits for different applications using operational amplifier

CO4: Demonstrate the working od multi-vibrators

CO5: Design wave form generators and analyze their characteristics

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